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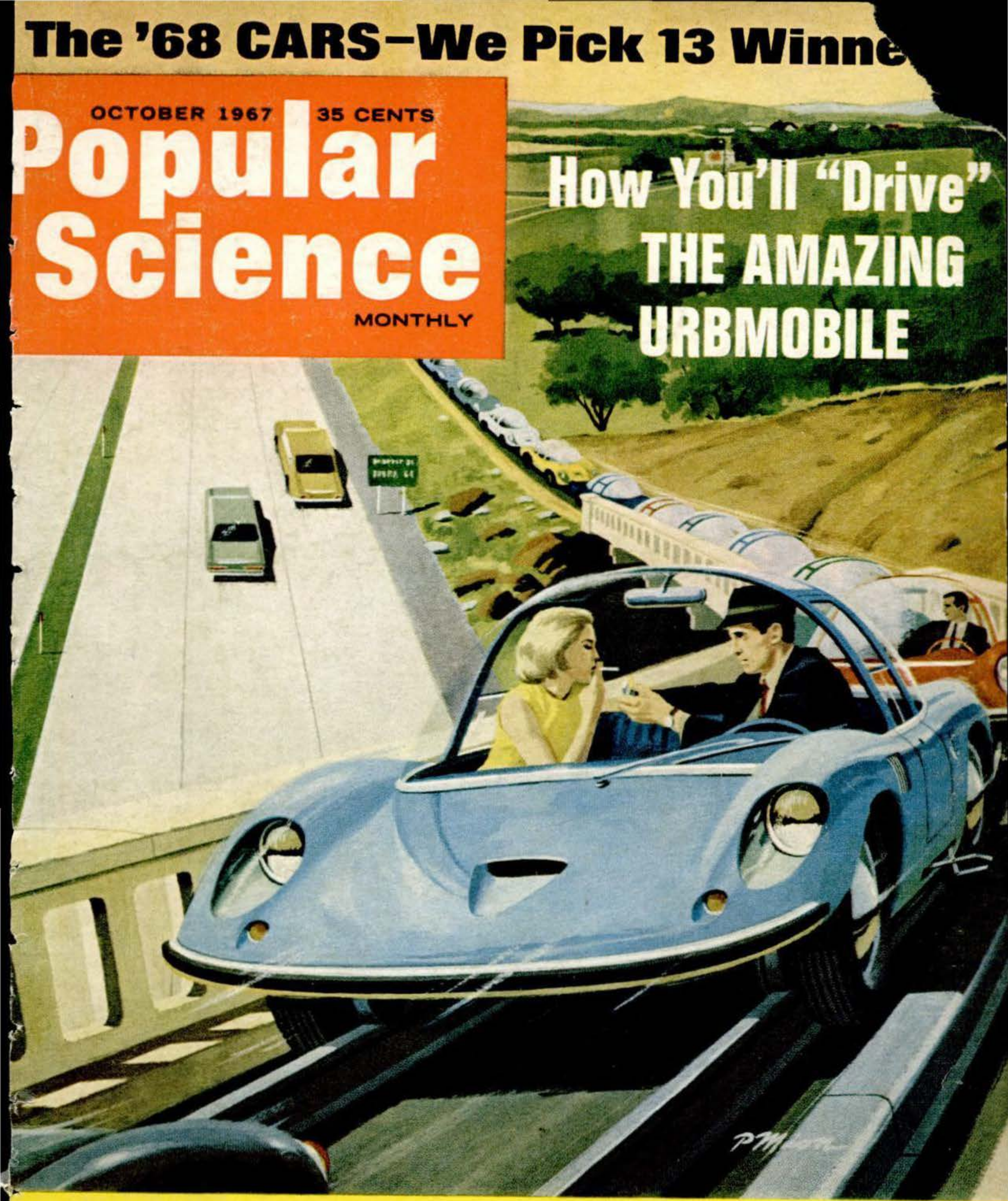

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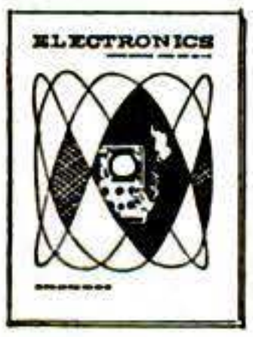

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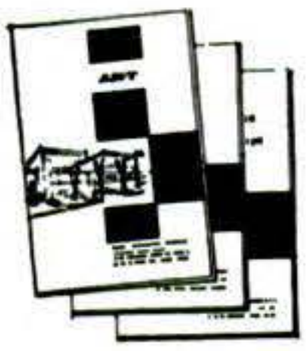

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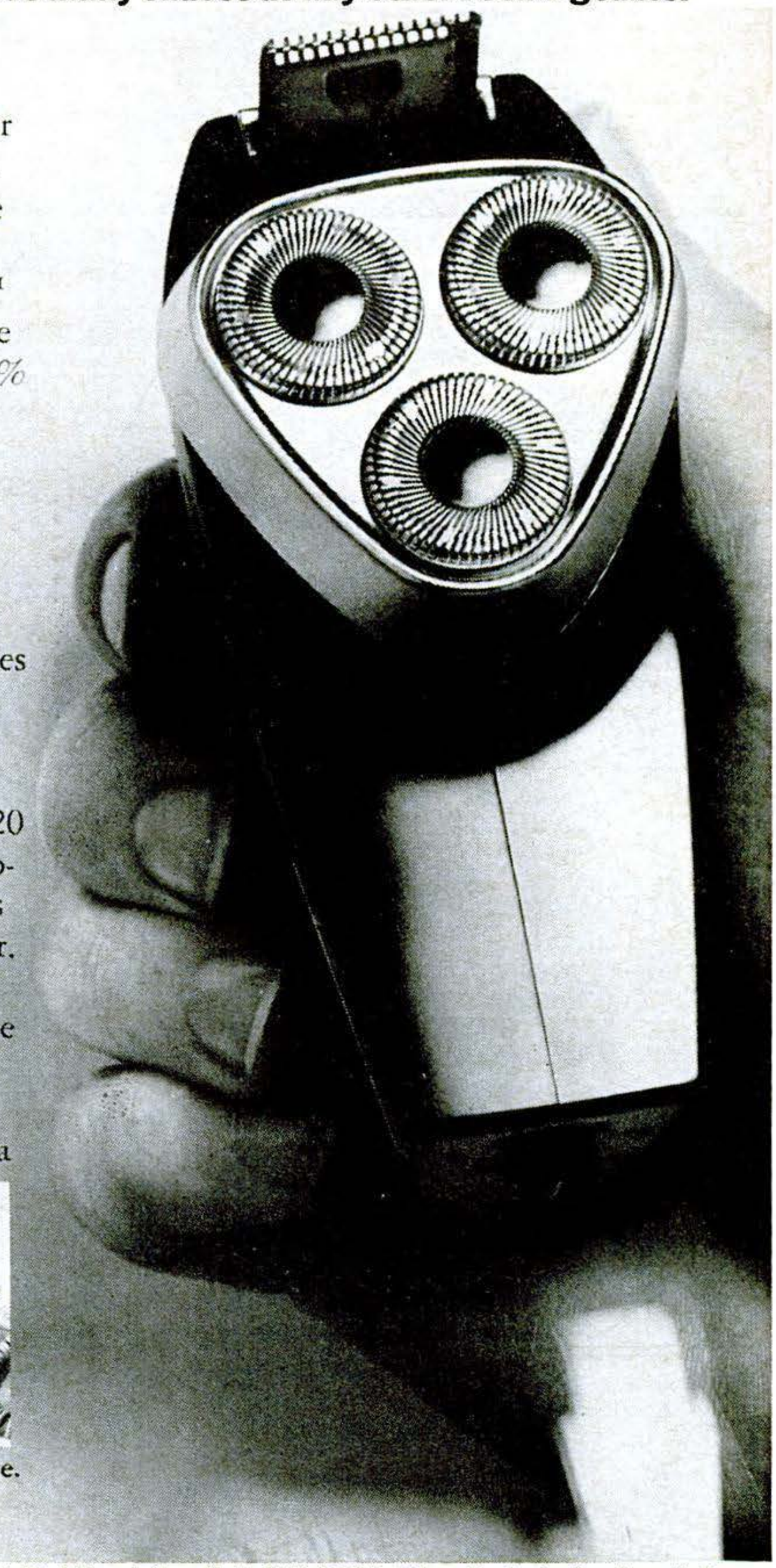

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Here they are, the outstanding '68 cars, chosen by PS experts, presented in full color . . . Also "Inside the '68s"—complete report on brakes, suspensions, engines, body details—on page 111

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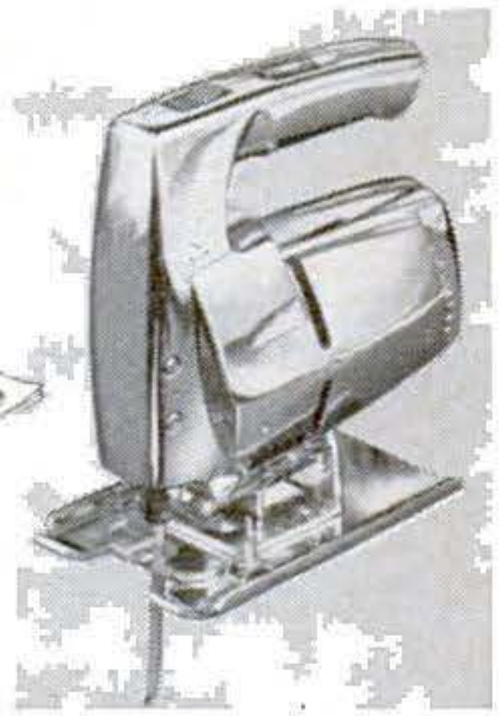

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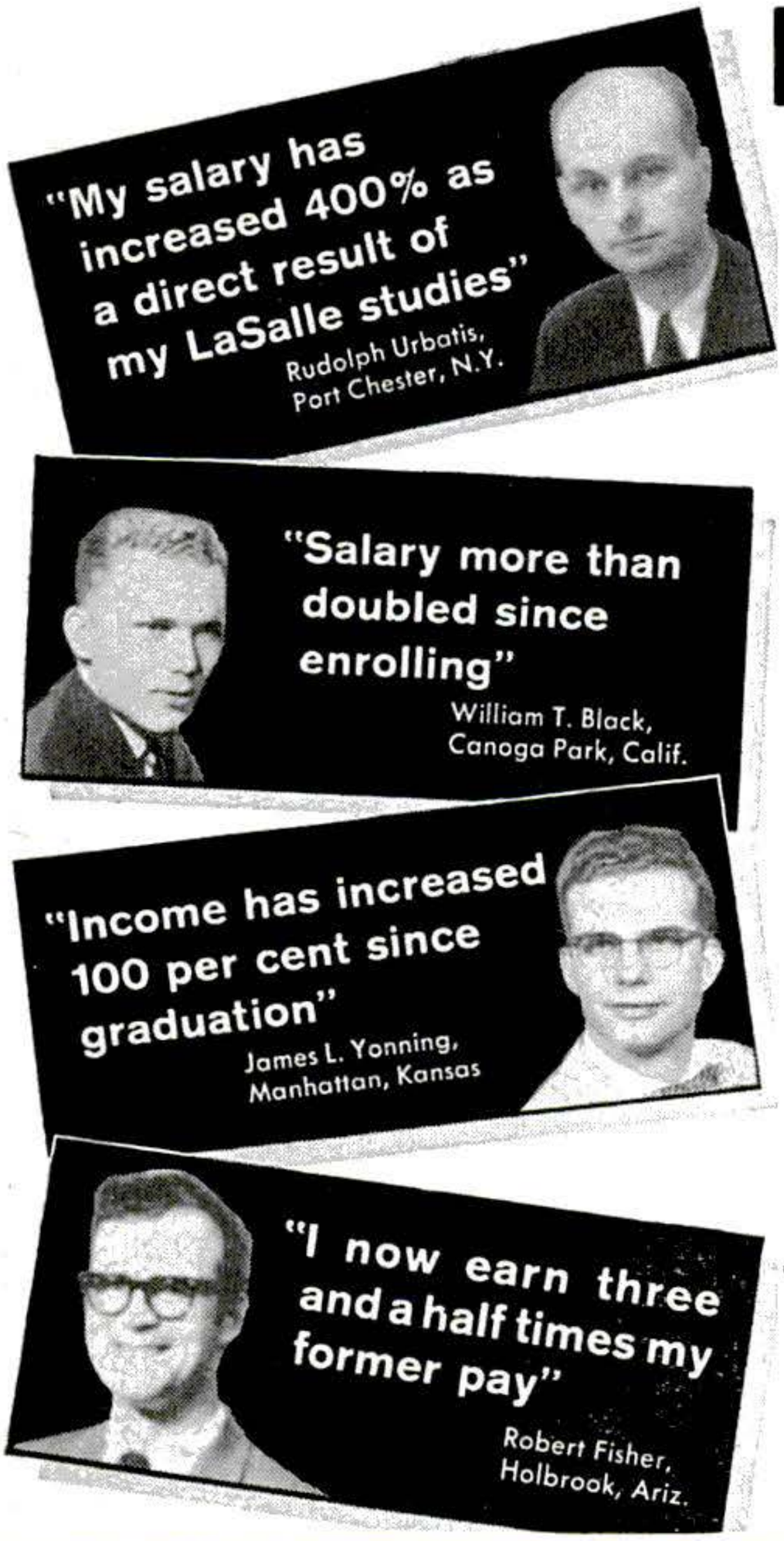

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Occupation..... Working Hours....A.M.....P.M.

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The how-to-glue chart.

Type of Material	Glue For General Usage (In Order of Preference)	Glue For Maximum Waterproof Durability (Boats, Exterior Construction, etc.)
All general gluing of hard and softwoods	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All	Elmer's Waterproof Glue
Particle and chip boards to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement Elmer's Glue-All	Elmer's Waterproof Glue
Plywood to decorative plastic laminates	Elmer's Casein Glue Elmer's Contact Cement Elmer's Plastic Resin Glue	Elmer's Waterproof Glue
Laminating heavy framing members	Elmer's Casein Glue	Elmer's Waterproof Glue
Veneering, inlays, cabinetwork	Elmer's Plastic Resin Glue (extended) Elmer's Glue-All (small jobs)	Elmer's Plastic Resin Glue
Bonding oily woods (teak, pitch pine, osage, yew, etc.)	Elmer's Casein Glue—sponge surface with dilute caustic soda one hour before gluing	Elmer's Waterproof Glue
End-wood joints, mitered joints, scarf joints	Elmer's Glue-All Elmer's Plastic Resin Glue (heavy mix)	Elmer's Waterproof Glue
Loose-fitting joints, relatively rough surfaces	Elmer's Glue-All Elmer's Casein Glue (heavy mix)	Elmer's Waterproof Glue
Doweling	Elmer's Plastic Resin Glue Elmer's Glue-All	Elmer's Waterproof Glue
Hardboard to plywood, wood or itself	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing porous materials—linoleum, canvas, etc. to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing plastics, metal foil, etc. to wood	Elmer's Casein Glue (sand both surfaces)	Elmer's Contact Cement
Gluing non-porous materials—glass, metal, iron, aluminum, bronze, brass, etc.	Elmer's Epoxy Glue	Elmer's Epoxy Glue

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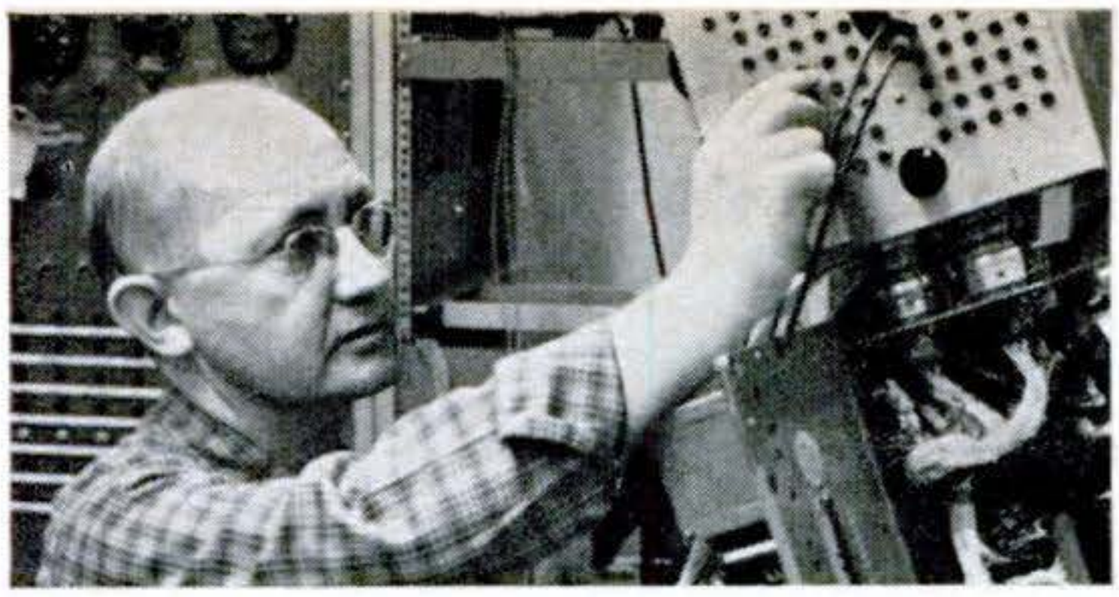

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Columbus, Ohio

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EDWARD DULANEY, Scottsbluff, Nebraska

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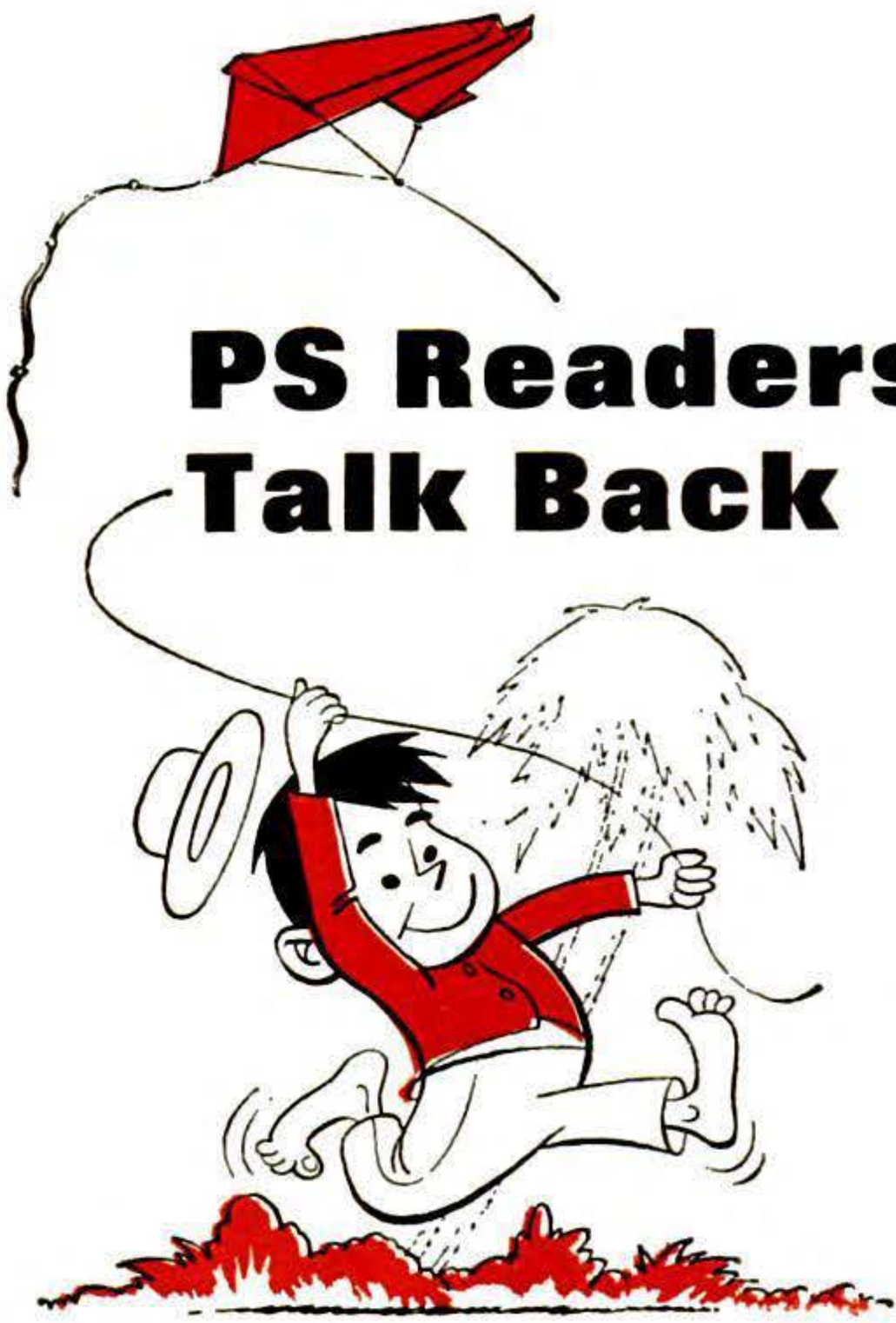


PS Readers Talk Back

Reentry kite is old stuff

I was amazed to read in "Build Your Own Reentry Kite" [July] that the "Chiringa" is going into space. The Chiringa is not a new invention, but a very popular kite among poor Cuban children, who cannot afford to buy a regular one. As early as 1928, I remember making Chiringas and flying them. I hope POPULAR SCIENCE will give proper credit in the space program to a humble and inexpensive toy that gave happiness and fun to thousands of poor kids who couldn't dream that they were playing with a future space reentry vehicle.

DR. ENRIQUE M. SENRA, Hilaleah, Fla.

The Chiringa is apparently widely known throughout the Caribbean and is also a favorite with Puerto Rican children.

Fill 'er up foamy again

"Things You Never Knew About Beer" [Aug.] tells only half the story. Filtering out taste-spoiling organisms makes possible the putting of draft beer into bottles and cans. But something else is needed, or it won't stay fit to drink very long without refrigeration because the brew can easily become contaminated during filling. A process known as aseptic filling is entitled to share the credit with membrane filtration for today's favorite packaged brews. This process came into being a few years ago with the discovery of an iodine-based sanitizer that can, according to FDA regulations, be used all during the filling operation on packages, fillers, crowners, and cappers, without any following rinse.

MORRIS BANNER, Bloomington, Ill.

Jumbo Jet article a big hit

Your article "Come Fly to Europe with Me in the New Jumbo Jet" by Devon Francis [Mar.] created so much interest that our offices throughout the world have been besieged with requests for reprints. We have already distributed 10,000 and more requests are still coming in.

RICHARD N. BARKLE, Director
Public Relations Bureaus
Pan American World Airways, NYC.

Go-Go engine's name is a goof-goof

The engine called a Suzuki in "The Go-Go Engines That Power Motorcycles" [Aug.] is really a Yamaha, model YL-1 engine.

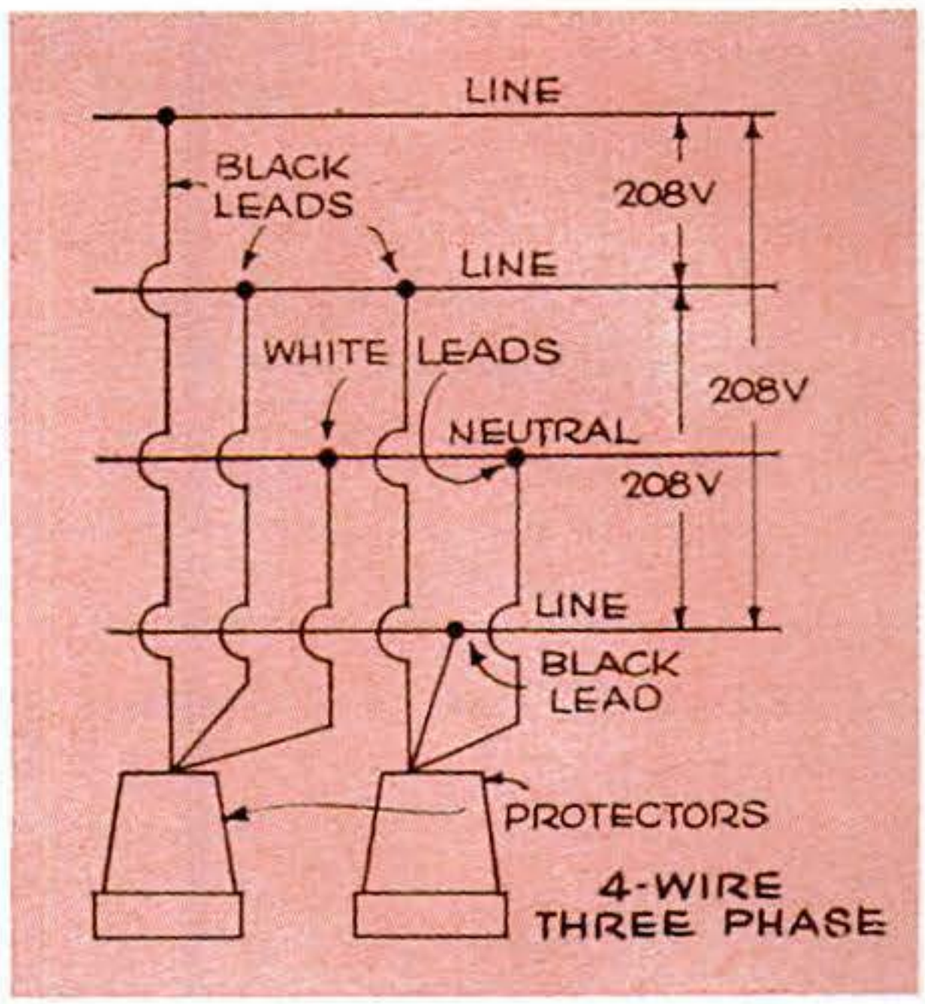
DAVID L. WORBY, Oshkosh, Wis.

Right you are.

Lightning protection for your home

I was startled by the wiring diagram in "Safeguarding Your Wires from Lightning" [Aug], which shows the installation of GE lightning protectors on a three-phase power line. Your sketch shows the three "hot" lines shorted together.

ROSS CUTTING, Cleveland, Ga.



Our draftsman goofed. See accompanying diagram for the way it should look.

Recording a sour stereo note

In your article on recording stereophonic sound ["Today's Stereo Sound," Aug.], you unfortunately used Enoch Light and his popular but artificial Ping-Pong sound as an example. In a true stereophonic recording

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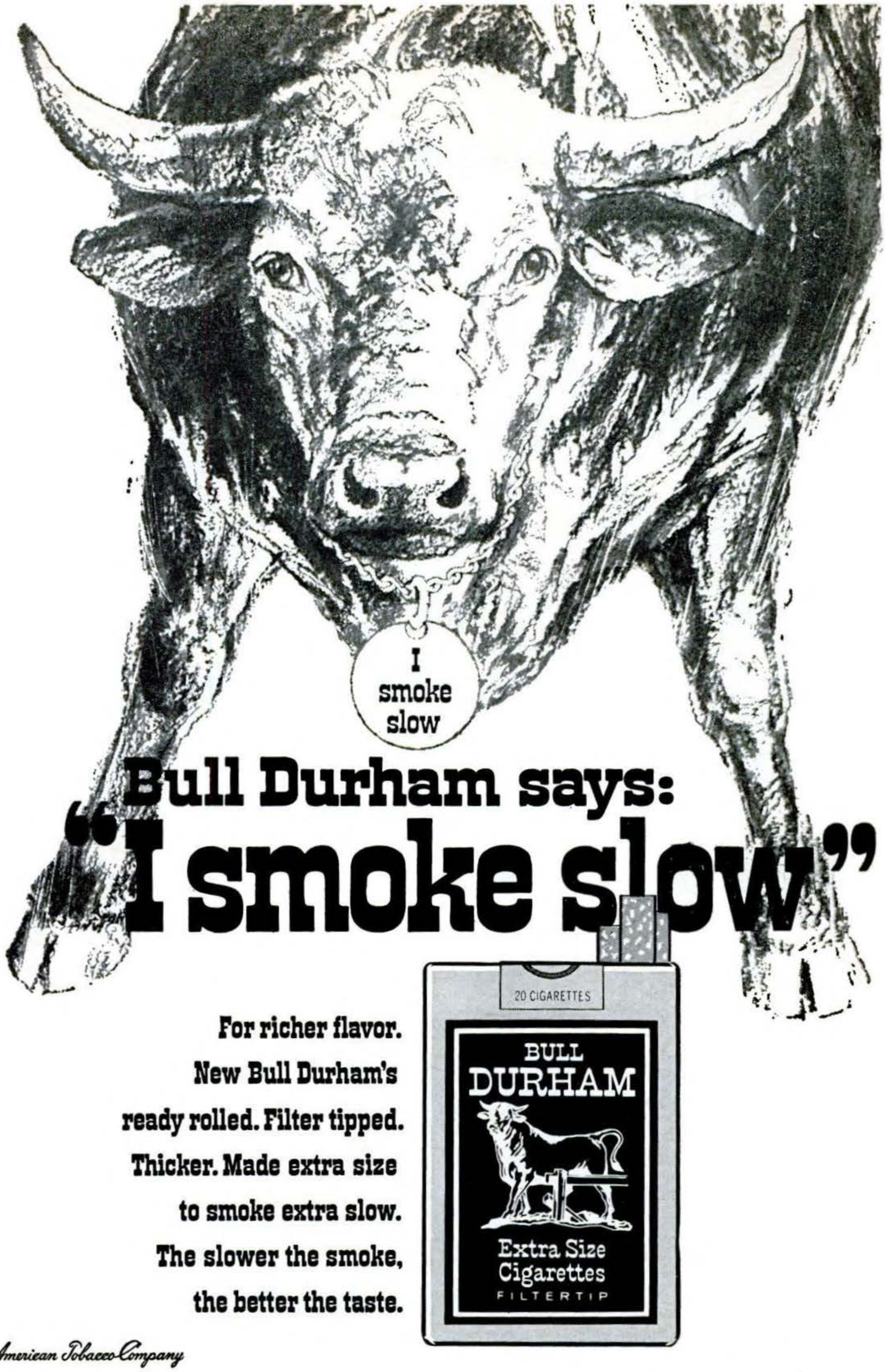

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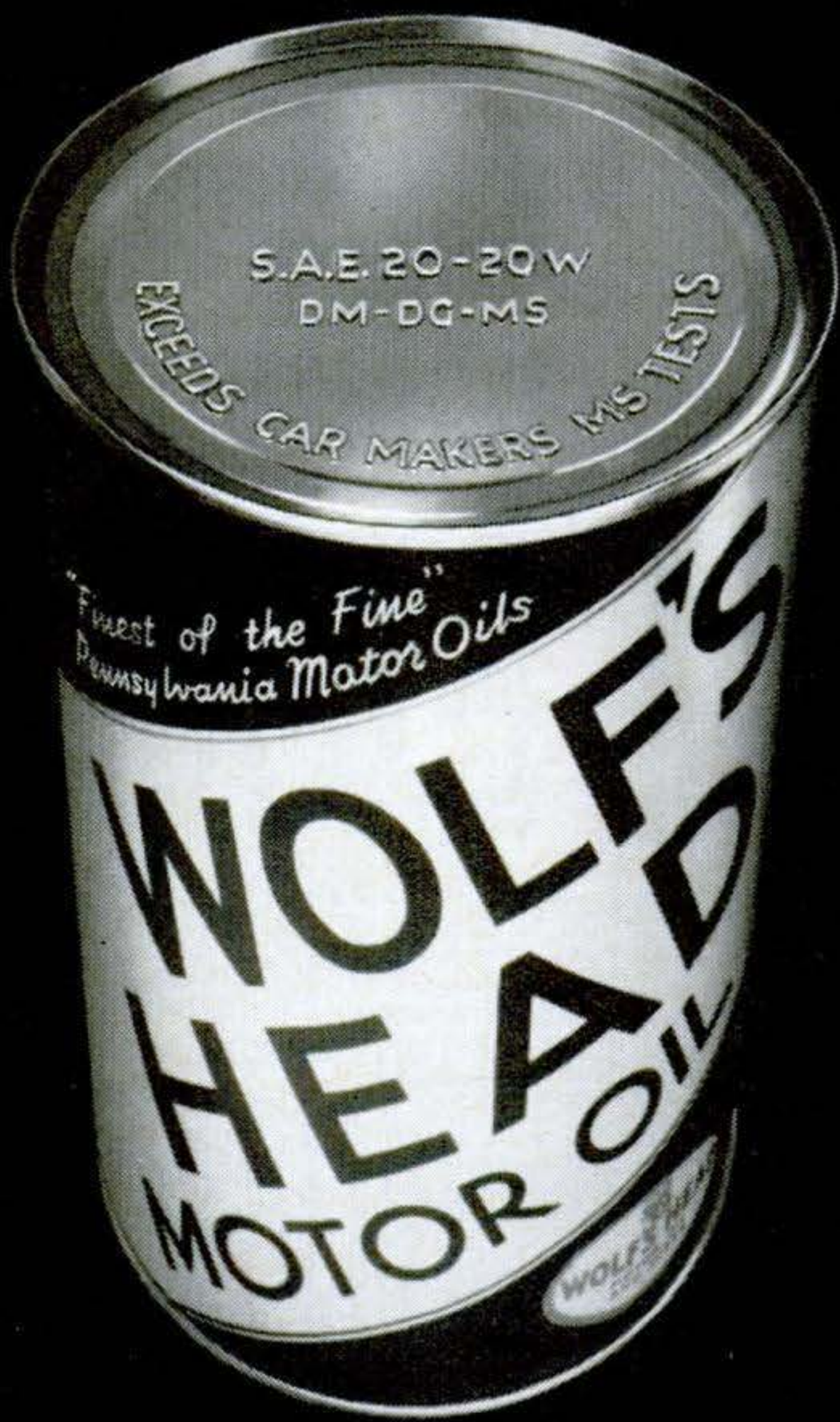

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PS Readers Talk Back

[*Continued*]

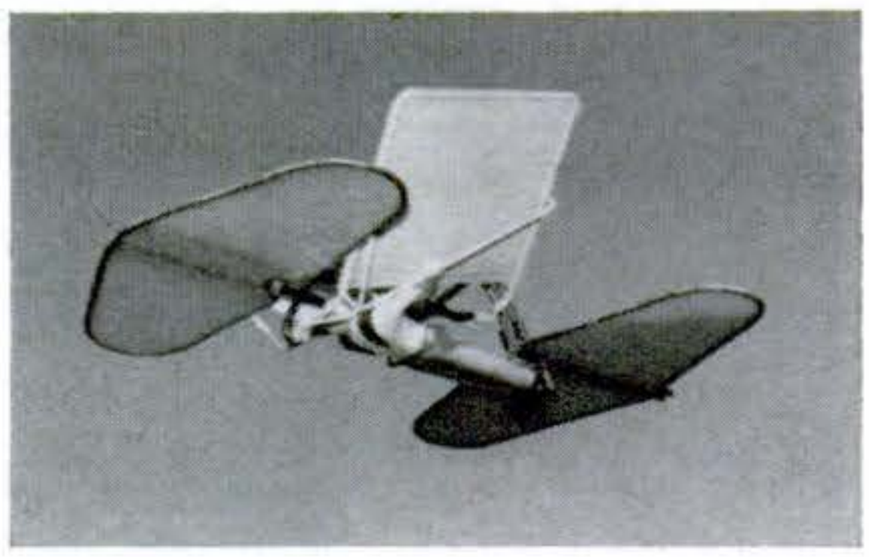
session the instruments are placed in the pattern the listener will hear when the final pressing is played. The Enoch Light type of recording produces a very artificial and directional sound. The acoustics of the room are not considered and reverberation on the record will come from electronic echo chambers. Any owner of a high-quality sound-reproduction system will tell you the Enoch Light type of stereo sounds thin and hollow when compared with a nongimmick, high-quality recording.

ROBERT L. WALTER, NYC.

The recording session pictured in the article was held in a professional recording studio where room acoustics are considered. No electronic echo chambers were utilized. We stand behind our statement that the recording does not contain artificial Ping-Pong sound.

You could fly—he says

In "Surprising New Facts About Your Muscles" [July] you say: "Given the right wing equipment, you could fly." This is something I have believed for a long time. I



have built a working scale model of an 'ornithopter' which might enable you to do just this.

HERB ALDRIDGE, Coalinga, Calif.

Insurance against rifle jamming

If the reports about the M-16 jamming are true ["How Good Is Our New Vietnam Rifle?," Aug.], why doesn't the government issue more Colt .45 automatics. Then if the M-16 does jam, soldiers would still have a reliable sidearm.

PERRY FONG, Sacramento, Calif.

A good thought, but adding a .45 and its ammunition would offset the lightweight advantage of the M-16 rifle.

Want to get something off your chest?
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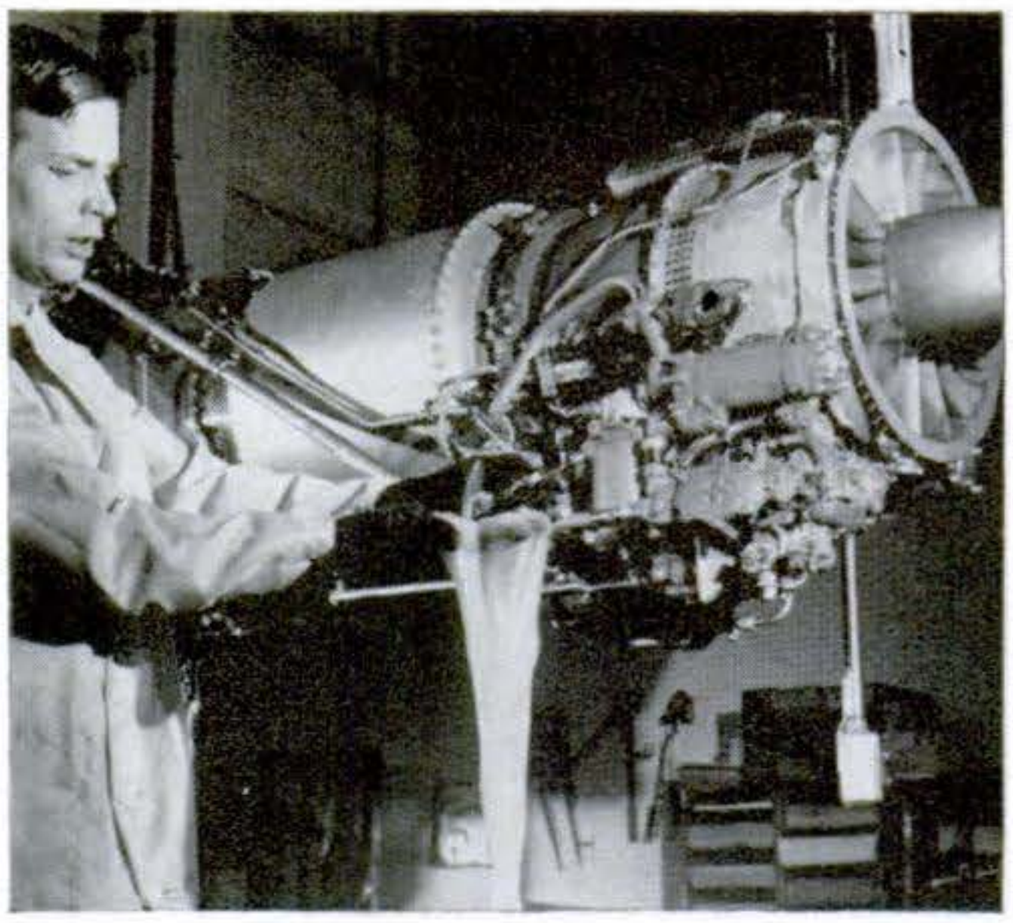
PS PICTURE NEWS

Wire tires for moon mires

When astronauts reach the moon, they may be radioing back, "Send up some wire. We gotta repair a tire." This moon buggy, designed by Boeing and General Motors, does indeed have wire tires. They help the vehicle climb over obstacles 45 inches high, cross crevices 55 wide, and maneuver without rollovers on slopes.



Gooey food for safer turbojets

The stuff you see dripping at the side of this turbojet engine is emulsified fuel. Sort of like petroleum jelly, it turns to liquid when injected into the combustion area of a jet. It was developed by Pratt & Whitney to cut down the chances of flash fuel fires. It's sold by the pound.

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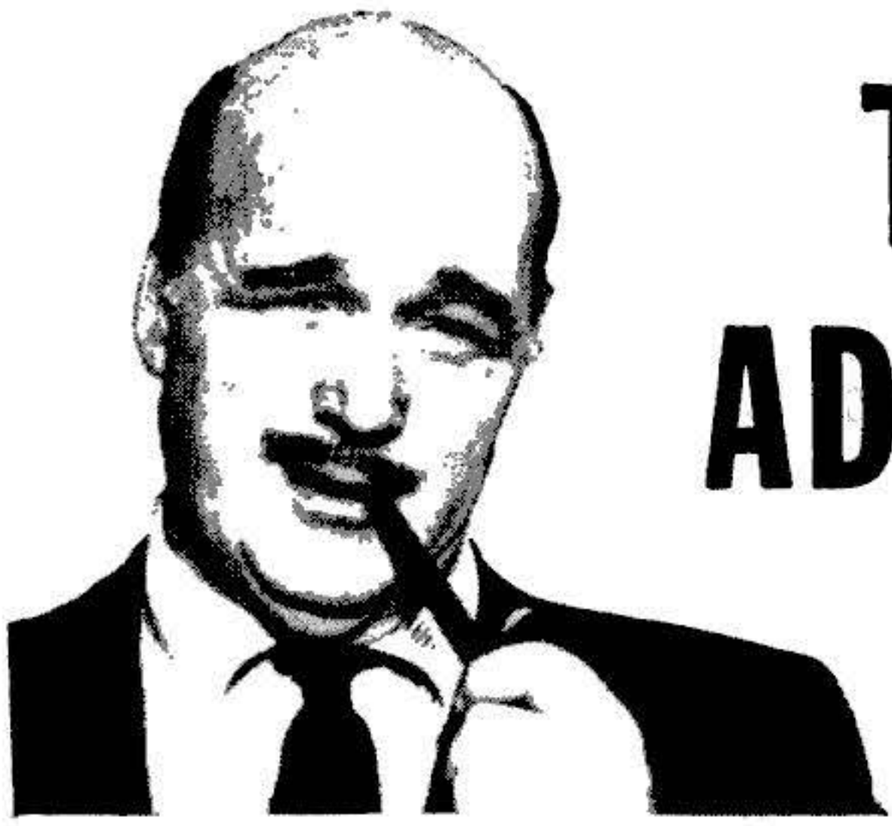

TOM McCAHILL ADVISES SATURDAY MECHANICS

If you're a Saturday mechanic, my guess is you can fix the screen door, build lawn furniture, overhaul the kid's bike, and rotate your own tires.

It's a different story when that fancy electric coffeemaker stops perking or the push-button automatic washer quits halfway through a cycle. You might spend an afternoon admiring the coffeemaker's innards before giving it a permanent vacation on the top kitchen shelf.

As for the automatic washer, after the Little Lady shouts "Do something!" you'll end up phoning an Appliance Serviceman across town. He shows up in 3 days and has the washer going in one-fourth the time it took you to study the coffeemaker. He also presents you with a ticket for 30 bucks. When you consider he could make twice that selling you a new machine, you got off easy.

Maybe you never realized it, friend, but you have more Appliances around your hacienda today than you did five years ago. If you count power tools, your wife's hair dryer, an air conditioner, plus the standard stuff like vacuum cleaner, toaster, refrigerator, freezer and so forth, you probably have well over a dozen.

These electrical gadgets nowadays represent a pretty good chunk of your hard earned dollars. Did you ever stop to think it could pay you in savings and convenience to know how to fix these things? Also, it could be a great source of extra income if you're inclined to tackle the few thousand broken Appliances right in your own neighborhood.

The Appliance Repair business is easier to learn than you imagine. The National Radio Institute's Appliance Division has a downright interesting, low cost course you can take in your spare time. It covers every type of Appliance you can think of plus air conditioning, refrigeration, house wiring, electric motors — even small gas engines. There's a worthwhile section on farm and commercial appliances too.

NRI starts you with the basic principles of electricity to give you a solid background. Using clear-cut picture diagrams, they show you how various types of Appliances work, separating each into groups. Included with the course is a topnotch, professional Appliance Tester for fast troubleshooting.

Easy to read, bite-size lessons are loaded with photos and cutaway drawings so you see how each Appliance comes apart, and more important — goes back together in working order.

Whether or not you agree that knowing Appliance Repair could help you, I recommend you see for yourself. The coupon below will get you a free book that fully describes this unique home training. No salesman is going to call.

Do yourself a favor and mail the coupon today.

Tom McCahill

TOM McCAHILL

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"Say, Smokey–"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please *print* your name and address.

"There is one question I've never heard a satisfactory answer to—what's the meaning of the letters that follow a car name, such as Pontiac GTO, Ford LTD, XL, GT, SS, and so forth?"

RONALD GERLING, Edwardsville, Ill.

This is mostly showroom catnip. So don't take the following literally. GTO stands for Gran Turismo Omologato, which means the car has been homologated—approved—for racing in the GT category; LTD does *not* mean Limited (which is a Buick-owned name); XL means just that spelled out—excel; SS means Super Sport; GT means someone left off the Omologato.

"Do you think there will be more turbine-powered racers at Indy next year, even though Parnelli's car broke down near the end this year?"

N. M. SMITH, East Dubuque, Ill.

Not unless they rejigger the rules again. After this year's race the rules were changed —based on the volume of intake air—to eliminate Parnelli's gas turbine, and there is nothing on the market of a size to fill the bill.

"I feel that I ought to be getting better gas mileage from my 1967 Dodge equipped with the 383-inch engine and automatic drive. I do a lot of stop-and-go driving."

B. R. TATUM, Boise, Idaho.

Dodge's latest technical service bulletin says you can improve your fuel economy on that engine with automatic in short-run driving if your carburetor is a two-barrel Bendix WWC-3-276. Adjust the choke vacuum kick, using a .120-inch drill. Use the procedure on page 14-52 of the Dart Coronet manual or on page 14-18 of the Polara Monaco manual.

"Should you check the oil level when the engine is warm or cold?"

BOB BASTION, Menomonee Falls, Wis.

Most cars should have the oil level checked when the engine is cold or has been stopped for 10 or 15 minutes. See if your owner's manual compensates the dipstick reading for accuracy when the engine has just been switched off. On most cars you will be overfull if you add oil to bring the dipstick to full right after shutdown.

"My 1966 Ford Galaxie 500 wagon has a terrible gasoline smell, but only while driving with the windows partly or fully open. The dealer can't solve the problem. He has tried drilling a hole in my gas-tank cap to 'stop vapor-pressure buildup.'"

ORVILLE H. PINE, Quaker, Pa.

This is no great problem. Fuel odors usually are produced by leaks or spillage on refill. If your dealer will look in the fill area, I believe he will find a leak in the vent system and maybe some small trap that holds the spilled fuel until it evaporates. You get the odor when you are driving with the windows open because this produces a low-pressure area in the passenger compartment and draws in the fumes.

"A manufacturer offers an adjustable main jet for the Volkswagen carburetor. If one of these is installed, how do you determine the optimum setting without a dynamometer,

Continued

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Entry blanks free where they sell ZEREX Anti-freeze. (No purchase required.) It gives all the details. All you do is mark your top choices, fill in your name and address and mail it. And you may be the big winner. (In Wisconsin, write your top choices, name and address on a plain piece of paper and mail to Du Pont Zerex Sweepstakes, P.O. Box 35581, Minneapolis, Minn. 55460.) ZEREX Pro Football Sweepstakes closes November 30, 1967. Void where regulated or prohibited by law.

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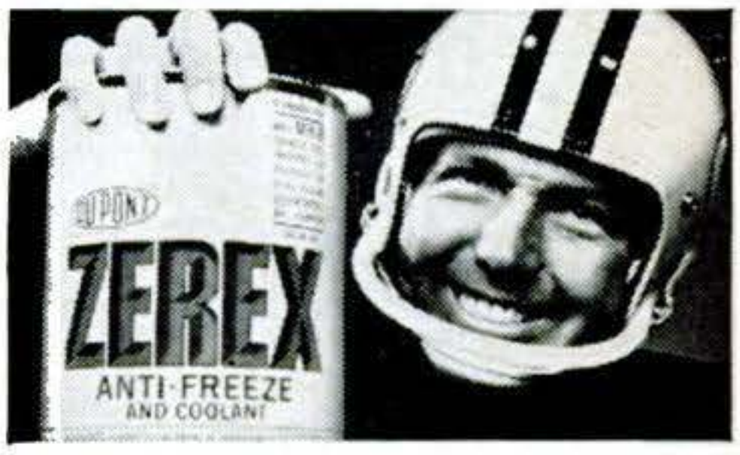

*First prize includes all these: A Pontiac Firebird, Philco home-entertainment center, Brunswick professional-size pool table, AMF Homko saddle-type lawn mower, Philco refrigerator-freezer, Autumn Haze mink stole, Philco portable TV set, Philco window room air conditioner, Lone Star boat, motor and trailer, AMF bicycle, Philco portable stereo, Bell & Howell movie camera and projector, American Tourister luggage set, Philco washer and dryer, Olivetti Underwood portable typewriter, Black & Decker home power workshop, Tyco road racing set, Apache camping trailer, Spalding golf club set, Dremel electric shoe polisher, Salton electrified serving cart, Schick electric hair dryer, Waring blender, Polaroid color camera, Singer sewing machine, Revere Wollensak tape recorder, and more.

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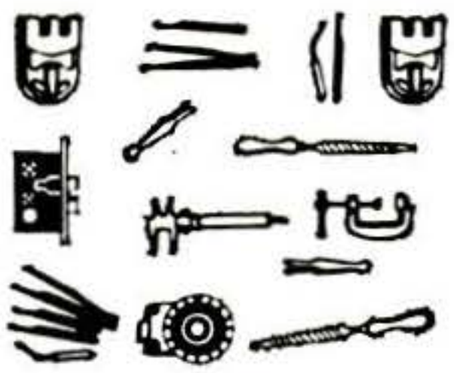

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setting caster at one-half to one-degree positive? Why does this model run negative caster? Is it because the steering arms and tie rods are to the front of the wheels?"

FRANK D. SHEPARD, Julian, N.C.

Road wander usually is caused by the front or rear wheels—or both sets—steering themselves from changes in their positions caused by car body roll. All cars "roll steer" to some extent. Have your car checked for tightness of all running-gear parts. Check the shocks closely. Install a heavier sway bar. Check the wheel alignment under normal driving load. Get new, lower-profile tires, and carry them at the recommended pressure. Negative caster is usually part of the front-end design, the idea being that this will reduce reaction from bumps. Steering arms and tie rods positioned in front of the wheel center is not the happiest idea in the world, but it is part of the necessary compromise that goes into car design.

"On inspecting the tires on my '65 Chevy I found one with a cut in the center, about a half-inch long and deep enough so I can see two cords cut. The tires are the original two-ply with plenty of rubber on them. Is the tire safe?"

ANTHONY J. DIVOLA, Sebastian, Fla.

No!

"I own a 1965 Corvair 500, 110 hp., with automatic transmission. There is a knock in the engine that occurs only when it is set to specs. My mechanic told me it sounded like a 'pre-ignition' knock, and he set the timing back two degrees. The knock stopped. Why is this so? What is a pre-ignition knock?"

GERALD ROTHSTEIN, Brooklyn, N.Y.

Pre-ignition knock is the noise you hear from premature fuel ignition, or from fuel exploding in the wrong area at the wrong time. It's very harmful to the engine. As engines get older, and build up more carbon, they are more prone to do this. You can experiment with different fuel grades and name brands, and usually help the condition. What your mechanic did, setting the timing just back of the knock, is a big help, even if it is out of spec.

Got a question on autos? Send it to:
"Say, Smokey—" POPULAR SCIENCE
355 Lexington Ave., New York, N.Y. 10017.
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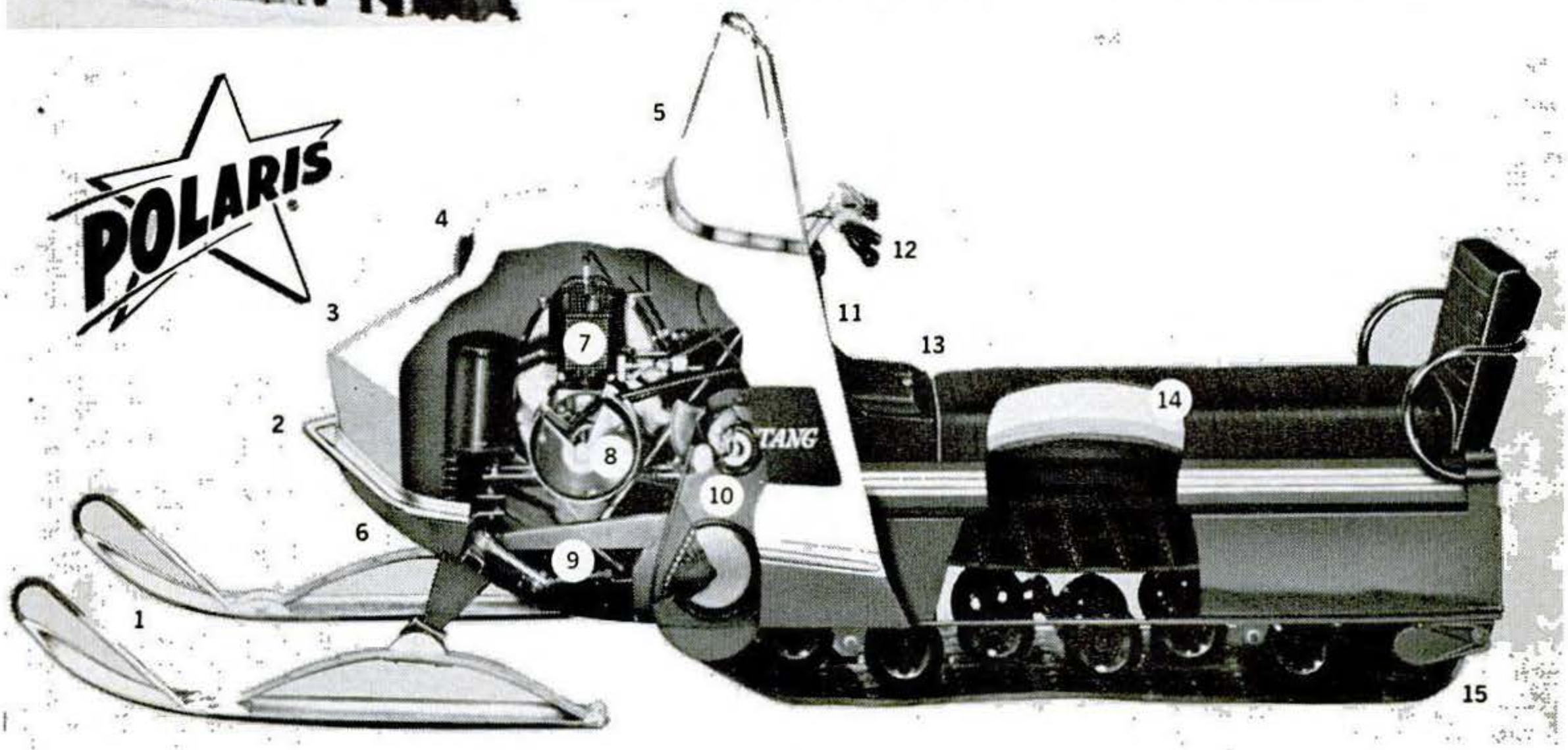

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12. New automotive-type braking system for safe, sure stops.
13. Convenient glove compartment.
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Science Newsfront

Last-minute news and notes to keep you up-to-date

By W. STEVENSON BACON

Two-man sky taxi

The two-man "Pogo" is the latest in small rocket devices from Bell Aerosystems. Designed for earth and lunar transport, it will be equipped with a long-range turbojet engine under development. This prototype flies with two Bell rocket-belt propulsion systems fastened together, operated in unison and flown by controlling the rocket nozzles with hand and arm motions. The hydrogen-peroxide jets give 600 pounds of thrust for 21 seconds. Possible uses: as a moon-exploration vehicle, and for rescuing persons stranded in inaccessible places here on earth, or for TV spot-news coverage.

Improving electric trains

Engineers are taking another look at a time-honored mode of transportation: the electric train. While they are quiet, fast, and smokeless, they pose serious problems for long-distance transportation. Fast systems have required special power sources, heavy overhead catenary systems, and many power-supply stations along the right-of-way. The Edison Electric Institute believes the catenary system over the tracks and the number of power-distribution stations could be drastically reduced by using very high voltages—25,000 volt, 60 Hz AC—to cut resistance losses. Electric railroads built to date have used lower voltages (600 to 11,000) and higher currents, and usually DC instead of AC. By converting to high-voltage 60 Hz AC, conductor size could be reduced and the major utilities along the road could supply the power.

Welding with dynamite

Strange as it seems, one of the best ways to weld pieces of dissimilar metals is with an explosive charge of dynamite. For small-scale welding of aluminum to steel, for example, a simple hand-held tool loaded with small explosive charges accomplishes the job quickly and efficiently. Larger, assembly-line jobs can be done in a low-grade vacuum chamber to eliminate noise and blast effects. Work on explosive bonding, done by Robert H. Wittman of the Batelle Memorial Institute, shows that explosives for welding are cheap, as little as 25 cents a pound, that it is reasonably safe with explosives insensitive to shock and heat, and that explosive bonding produces stronger welds at less cost than other methods.

Flat television set is unveiled

The closest thing to a flat TV "picture panel" may be a small TV set just two inches thick recently demonstrated by Hayakawa Electric Co. of Osaka, Japan. Secret behind the small depth of the set, which could easily be hung on a wall, is a flat picture tube. Unlike a conventional picture tube, the electron gun is mounted at the bottom of, and at right angles to, the screen. As the electrons flow upward, a deflection electrode along the back of the picture tube deflects them 90 degrees so they'll strike the screen. While similar picture tubes have been experimentally produced by other companies, the Hayakawa unit is the slimmest practical receiver ever demonstrated. The company hopes to produce the tiny TV set commercially in the near future.

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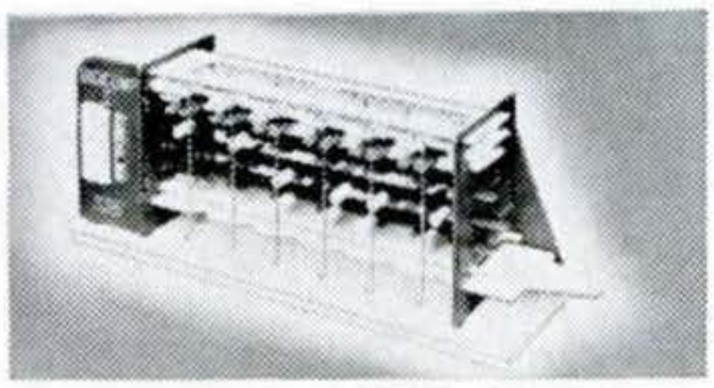

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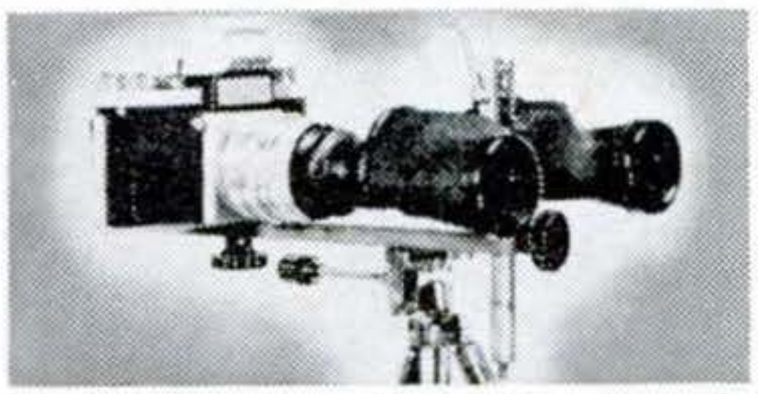

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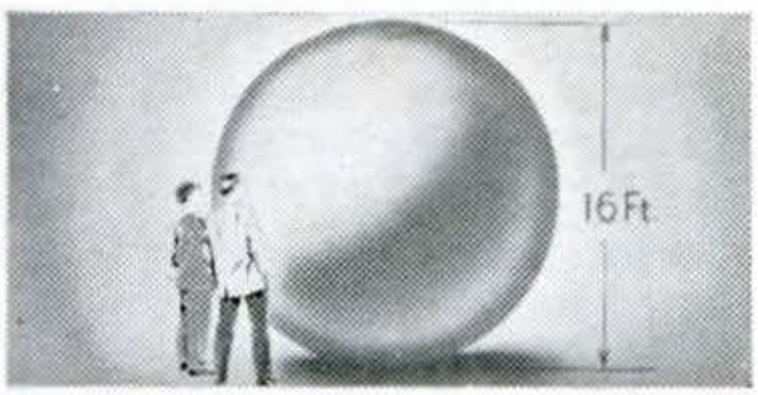

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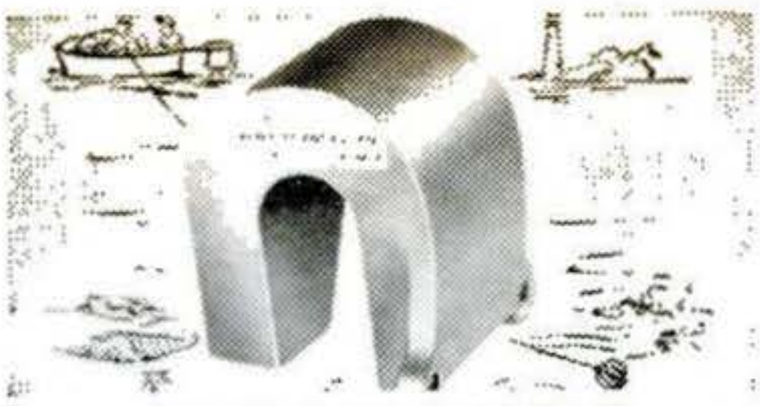

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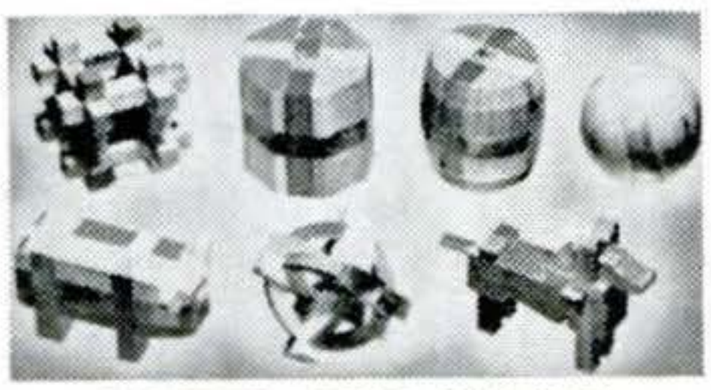

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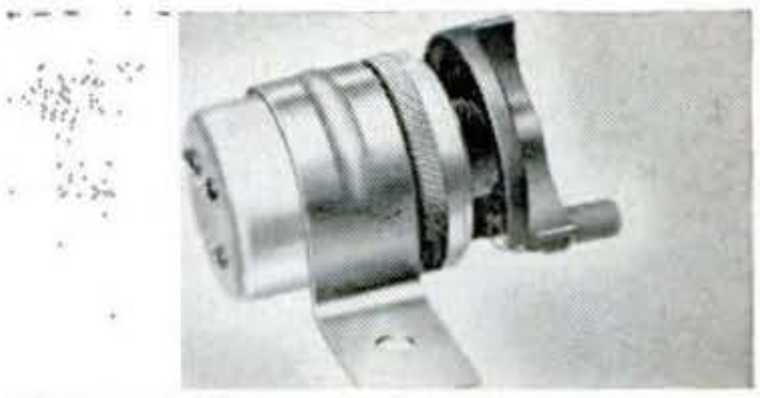

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Science Newsfront
[Continued]

Distorting glass foils spies

A simple, foolproof method of coding and decoding secret documents has been developed in Great Britain. All that's required are two pieces of glass about the size of magnifying or reading glasses. Although they appear quite ordinary, their hidden secret is that they are made of thousands of randomly twisted glass fibers. Held over a printed page, they chop the type into meaningless squiggles. A document photographed through the glass can only be read through a matching glass. It is impossible to decode a document without the right glass, and no one could construct one without knowing in advance the exact arrangement of the twisted glass fibers.

How does your car handle?

What kind of steering, braking, cornering, and accelerating qualities should your car have for utmost safety? Researchers at Cornell Aeronautical Laboratory have a contract with the new National Highway Safety Bureau to find answers as part of a program to set minimum standards for car-handling qualities. Defining "handling qualities" as "those characteristics which, in combination with a driver, determine how well-behaved the vehicle is and how easily it can be controlled under all driving conditions," the experts will try to find ways to improve driver-vehicle interaction and car stability control. Driving skills may also need revamping. For example, recent tests show that the average driver too often locks his brakes and loses control in emergencies better avoided with evasive action. A little training in evasive maneuvers may solve the problem.

Tape electrodes give batteries long life

A new kind of dry-cell battery may one day power toys, tools, even large appliances —and last as long as the device itself. In conventional dry cells, the electrodes are eaten away by chemical action. In a new tape-fed unit, described by Bernard A. Gruber and Dr. Joseph J. Byrne of Monsanto Research Corp. in *New Scientist*, the coatings on either side of a moving tape serve as electrodes that constantly renew themselves. The anode, or fuel, is on one side of the tape, the cathode, or oxidant, on the other. As the electrodes are eaten away, spent tape winds onto a takeup reel and new tape from a supply reel takes its place. One experimental tape battery uses magnesium and fluoramine to deliver over 200 watt-hours per pound of battery. A conventional silver-zinc

Continued

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Which stars have planets?

The slow rotation of our sun and many other stars, widely thought to be due to the presence of planets, is actually due to the braking effect of expanding magnetic fields. This conclusion, reached by Dr. Robert Kraft of the Mt. Wilson and Palomar Observatories, opens wide the question of how many stars have planets. Kraft, studying 200 stars about the size and brightness of our sun, theorizes that the solar wind emanating from the sun contains clouds of hot plasma gas that carry with them the flux lines of the sun's magnetic field. As the magnetic field lines stretch between the sun and receding gas clouds, they act like rubber bands, applying a torque that slows the sun's spin. Most stars the size and brightness of the sun also spin at a relatively slow speed—and, logically, it was found the older the star the slower the spin. Other stars which are larger and hotter are not subject to magnetic braking and spin faster, regardless of age. But their speed does not necessarily mean they do not have planets.

New tool may bring major new drugs

A new device that literally takes a protein apart and analyzes it molecule by molecule has been designed by Dr. Par Edman of Melbourne, Australia. Its significance may be enormous: If the exact structure of proteins were known, it would be possible to design drugs to deal directly with certain body defects. The biochemical activity of proteins depends on their exact structure. They are made up of sequences of amino-acid molecules, hundreds of them, and determining this exact sequence for one protein currently takes a 10-year research project. The Edman machine is fed a tiny amount of the protein and carries out at least 50 steps unattended, analyzing, in conjunction with a computer, molecule sequence.

At last! An end to lawn mowing

There may be good news for home owners tired of that regular summer chore, mowing the lawn. According to recent reports, a chemical that inhibits the growth of grass without discoloring or harming it has been developed and successfully tested in Europe. Known as Terasex, it has already gone into full-scale commercial production at the Jiri Dimitrov Chemical Works in Bratislava, Czechoslovakia. PS

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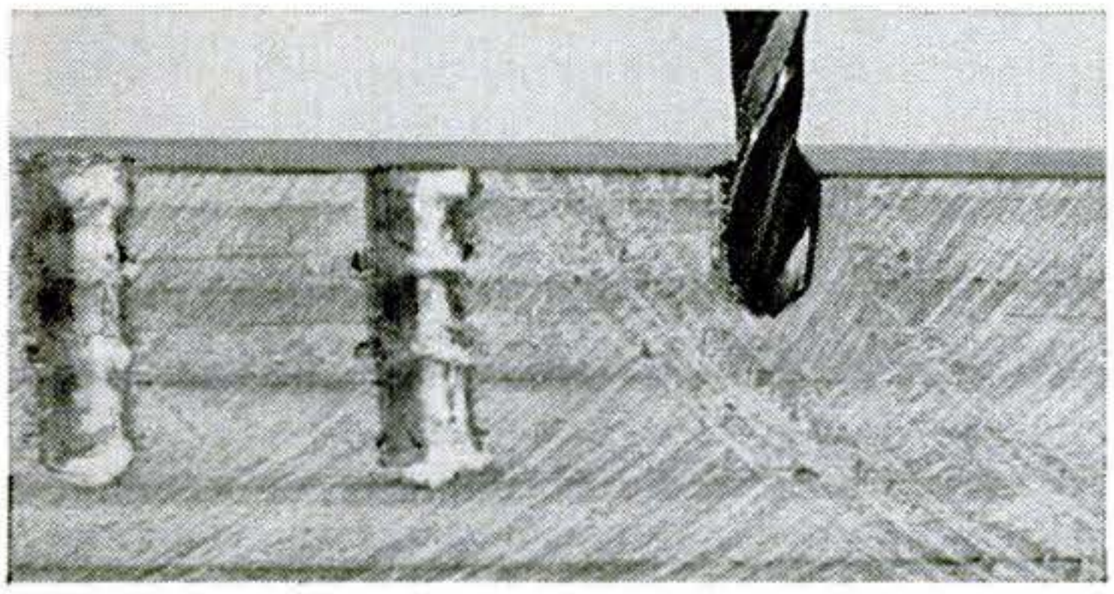
Seven workshop headaches. Seven Mystik Tape Cures.

1. Drilling a Finished Surface:

When you're drilling a finished wood surface, the drill can skid out of the punch and scar the finish. You can avoid this by sticking a piece of Mystik Clear Plastic Tape over the spot you want drilled. This skidproofs the surface. So you won't have to worry about damaging the finish.



2. Removing a Tap Washer Without Scratching the Chrome:

When you're changing a faucet washer, wrap the chrome packing nut with Mystik Electrical Tape. You'll avoid scratching the nut with the wrench.

3. Keeping Wood From Splintering When Sawing:

A strip of Mystik Masking Tape placed on the underside of the wood, along the cutting line, will keep the edges from splintering while you saw. (This is especially helpful when you cut plywood.)

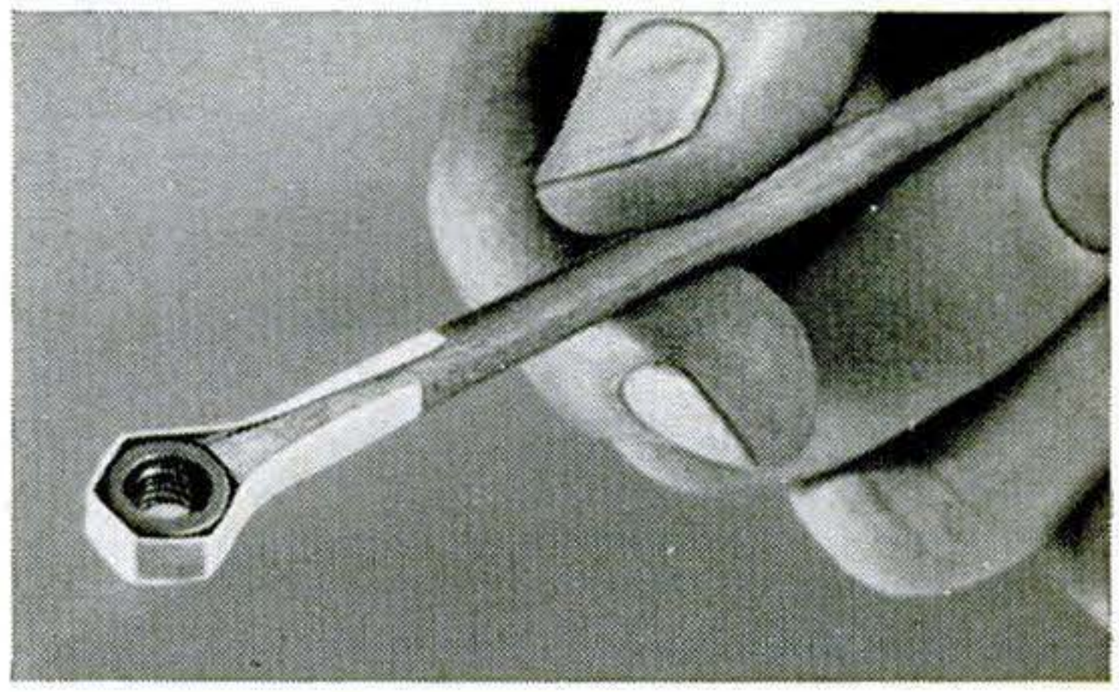
4. Losing Small Parts:

Mystik Double-Faced Tape makes a great no-spill parts rack when disassembling and reassembling a small motor. Stick a strip of the tape on your bench and press the parts on it in the order of disassembly. This makes reassembly easy.

5. Tools Without Handles:

If you don't have handles for all your files or hacksaw blades, wrap Mystik Electrical Tape around the tangs, and you'll fashion a working handle.

6. Threading a Nut To An Inaccessible Bolt:



If you have to thread a nut and bolt in a place you can't reach with your fingers, cut a piece of Mystik Masking Tape (as wide as the nut is thick) and use it to mount the nut on the end of a pencil, butting the side of the nut to the pencil. This way, you can hold the nut in place while you turn the bolt into it.

7. Holding Tacks on Hand-Tool Heads:

If you're working with small tacks, place a piece of Mystik Double-Faced Tape over the hammer head. The tack will stick easily to the tape. You can then give the tack a firm, direct hit.

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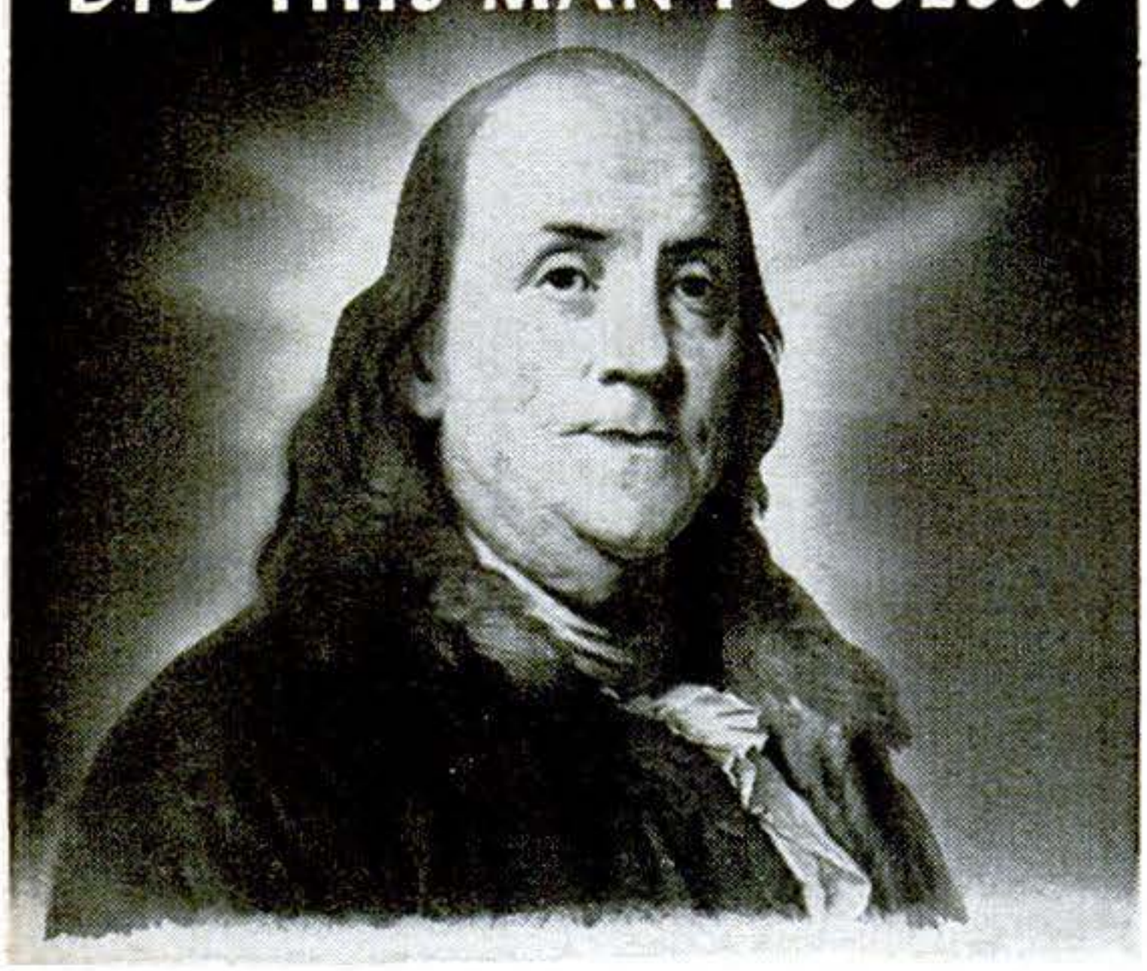

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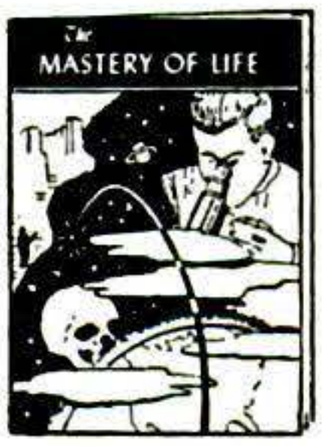

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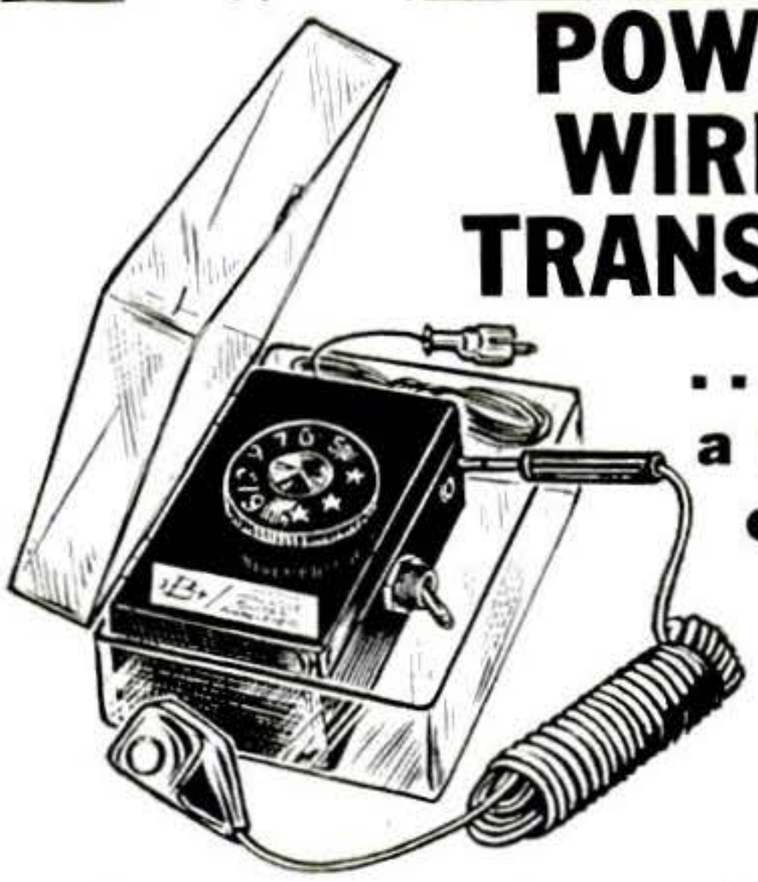

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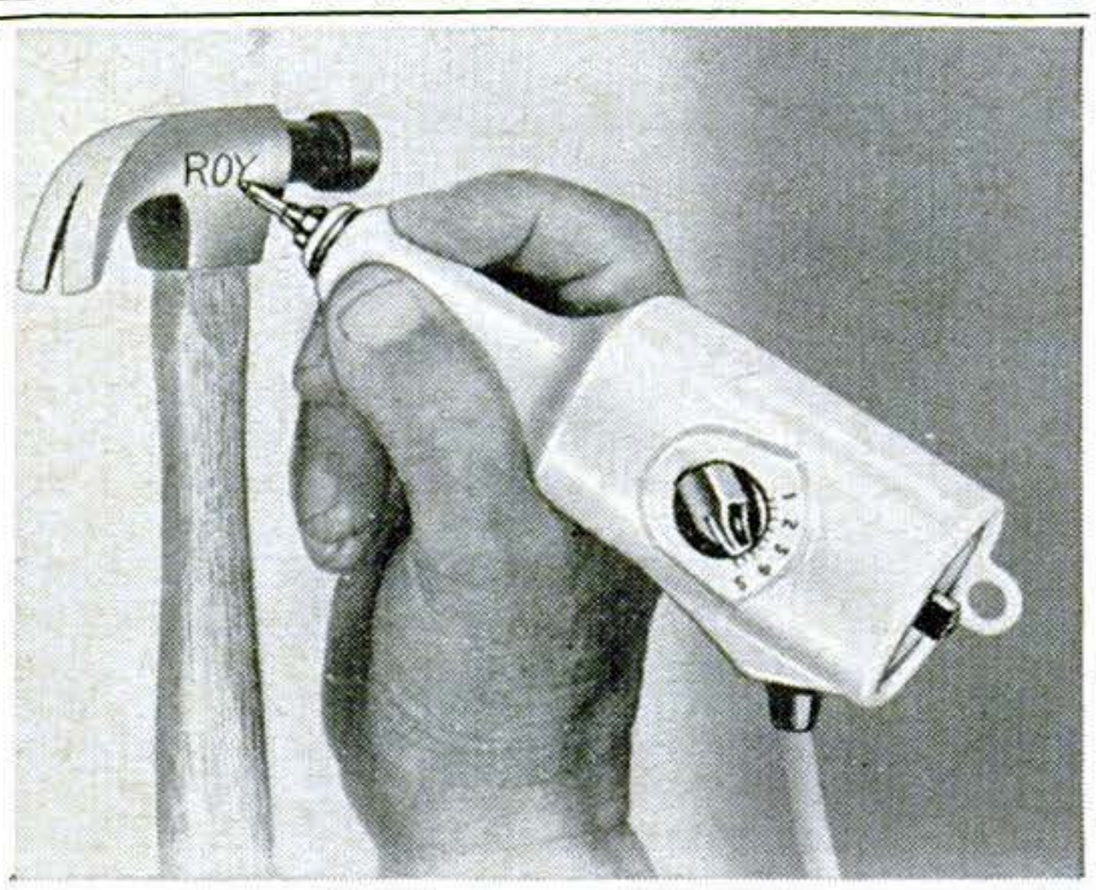

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Send 10c for new catalog of novelties, live animals, scientific supplies, hobbies, funmakers, planes & boats, looms, magic tricks, joke articles, unusual seeds, gadget timesavers, cameras, optical goods, projectors, movies, lucky jewelry, religious novelties, disguises, musical instruments, stamps, coins, puzzles, fortune tellers, radios, auto & bike accessories, telescopes, magnifiers, compasses, banks, smokers' gadgets, artists' supplies, printing sets, engines, motors, shockers, knives, billfolds, fireworks, guns, rifles, sports, books, games, plants, etc. Send name, address & 10c to: Johnson-Smith, Dept. 250 16535 E. Warren Detroit 48224

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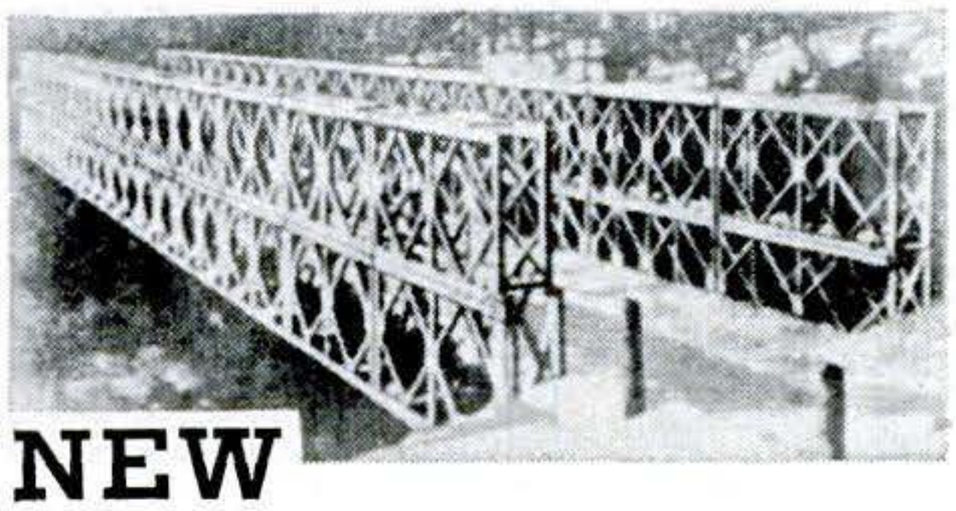
PUT THIS ON RUST & SAVE—MILLION DOLLAR DISCOVERY
REMOVES RUST QUICKLY BY POWERFUL CHEMICAL ACTION



NEW

NO MORE SCRAPING!
NO MORE SANDBLASTING!
NO MORE WIREBRUSHING!

NAVAL JELLY Eliminates the time and drudgery of rust removal and does the job far more effectively than old, harsh mechanical methods.

NAVAL JELLY

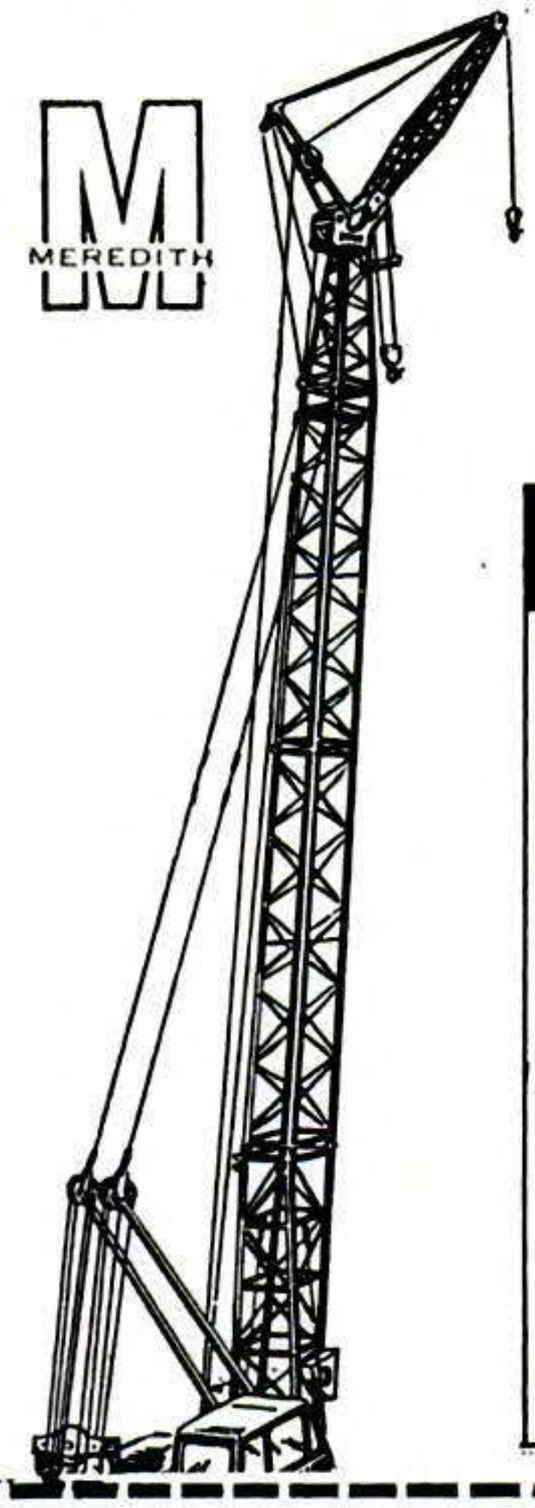
DISSOLVES RUST FROM IRON & STEEL

ALSO REMOVES RUST STAINS FROM CONCRETE

NAVAL JELLY ADHERES EVEN TO CEILINGS!

NAVAL JELLY is a tacky gel . . . just right to keep it in position on vertical or overhead surfaces. It will not stiffen or evaporate in tropical heat or arctic cold. It will not flow away.

MEREDITH



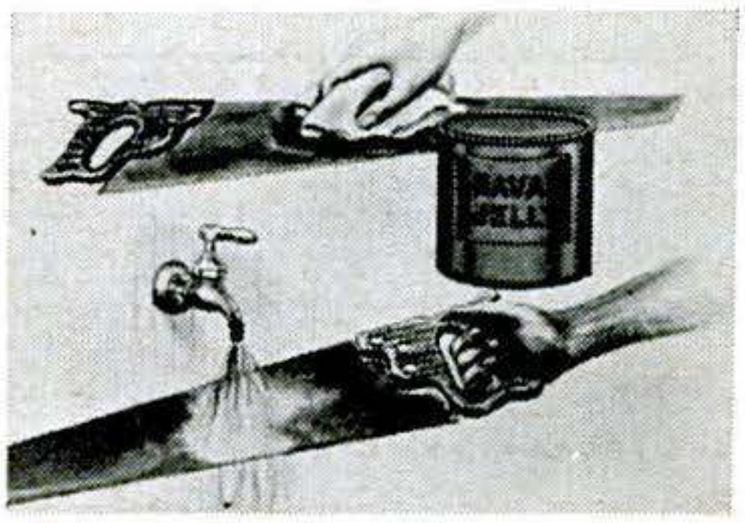
BRUSH IT ON. Let stand a few minutes or several hours depending upon the depth of the rust. **HOSE OFF WITH FRESH WATER.** After all of the Naval Jelly and rust is gone, the dry surface will contain a rust inhibitor, a thin, clean film. This will prevent further rusting and may be painted over.

CONSUMES 47 TIMES ITS WEIGHT IN RUST

Use Naval Jelly on
- Pipes • Boilers • Scaffolding
- Gutters • Tools • Fences
- Autos • Tractors • Ships
- Guard Rails • Structural Steel
- Water Tanks
- Chemical Equipment
- Lifts • Cranes • Screens
- Concrete Forms • Fire Escapes
- Gutters • Metal Roofing
- Cranes • All Machinery
- Oil Tanks • Drums • Plows
- Park Equipment • Swings
- Trucks • Buses • Boxcars
- Conveyors • Smoke Stacks

REMOVE RUST STAINS FROM
- Concrete • Terrazzo • Tile
- Stone • Vinyl Tile • Linoleum

TAKE RUST STAINS OUT OF CLOTHING



NO ACID FUMES

Naval Jelly contains no muriatic acid. It is fumeless, harmless, safe to use. It dissolves rust, mill scale . . . even oil and dirt. It does not attack the metal at all, but leaves a clean, rust-inhibited surface and improves bonding properties of paint if painting is desired after rust removal. Because Naval Jelly is safe to use, safe to store, non flammable . . . unskilled personnel can apply it. It is quickly soluble in either cold or hot water, has a pleasing odor.

COVERAGE: Naval Jelly will remove rust at the rate of 80 to 200 square feet per gallon, depending upon the thickness and condition of the rust.

SPECIAL INTRODUCTORY package of NAVAL JELLY is 4 pounds as shown on coupon below, postpaid. Normally freight is prepaid on 200# only.

IN LIQUID FORM for de-rusting and descaling of parts . . . our well known Rust-B-Gone.

MEREDITH SEPARATOR CO.

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Cleveland, Mo. (Missouri) 64734
Phone 816 221-3562

Ship NAVAL JELLY as follows:
- ☐ 40# steel pail @ 65c per pound fob Cleveland (total $26.00)
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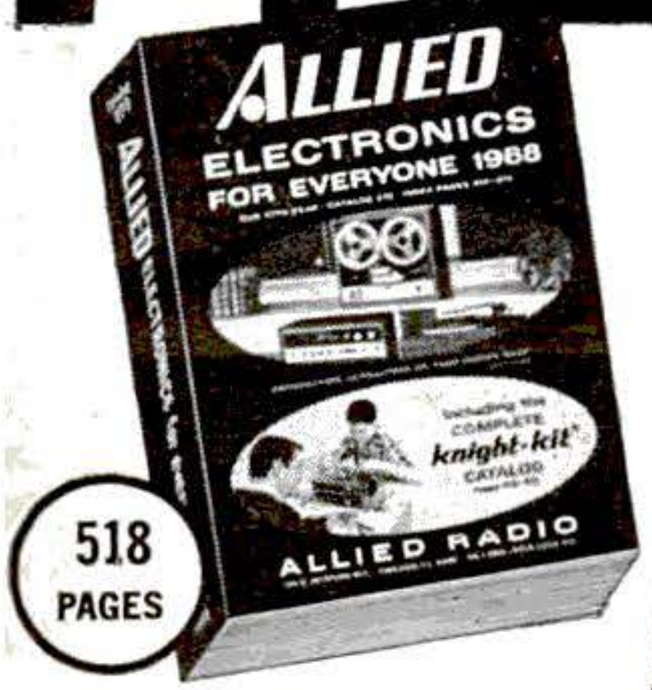

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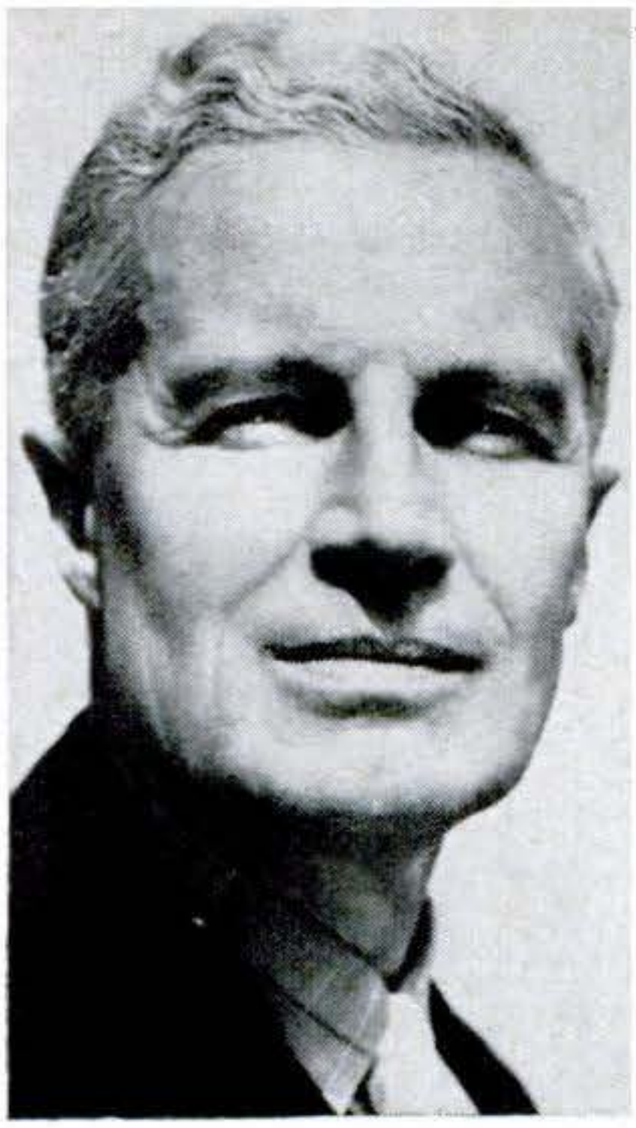

I'd like to give this to my fellow men...

while I am still able to help!

I was young once, as you may be — today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
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Comes complete, ready to use. Tune-up and operating procedure manual included, describes in detail how to make all tests. Also includes manufacturer's dwell angle recommendations for all cars. The manual is yours to keep even if you decide to return the instrument. **$29.95**

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Try it for 10 days before you buy. If completely satisfied then send $5.00 and pay the balance at the rate of $5.00 per month until the total price of $29.95 (plus P.P., handling and budget charge) is paid. If not completely satisfied, return to us, no explanation necessary.

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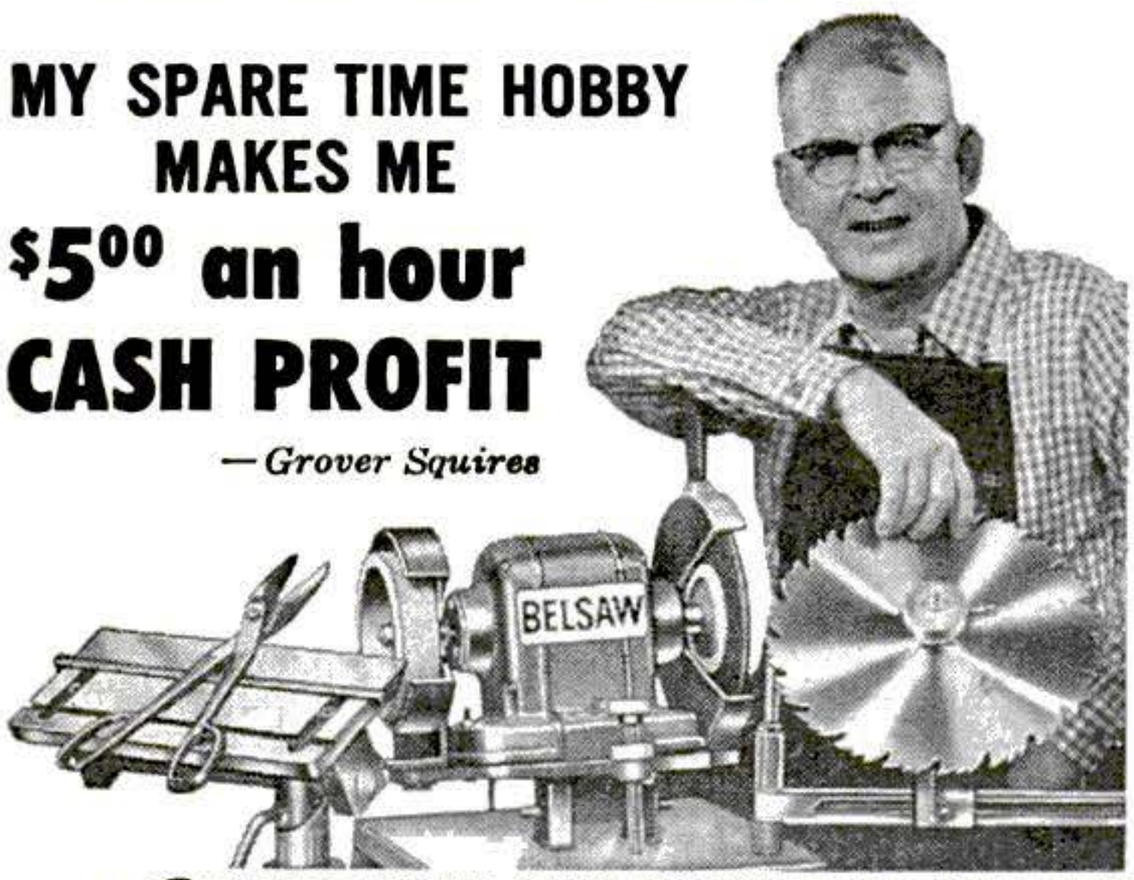
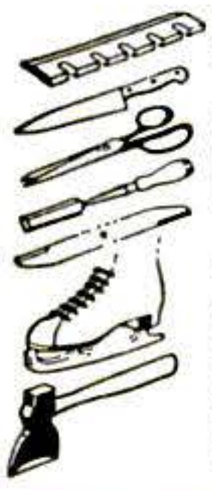
—Grover Squires





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How to get rich

How can you get rich some day? Make a hit record . . . a killing on the stock market . . . or invent a gadget like the hula hoop?

For most of us, these are just dreams. But have you ever stopped to think that there *is* a way to get rich—possibly only one sure way? Most fortunes, as you know, are made by people who own their own business.

Perhaps you've thought of starting a small business of your own . . . a franchised drive-in, or maybe a service business. Trouble is, you need $10,000 to $15,000 to get started and even then it's a gamble —with slim chance of ever making really big money.

But there is *one* business which could make you rich—almost overnight. And the beauty of it is, you can start on a shoestring during your spare time, even while holding your regular job.

Cash by Mail

The business is Mail Order—and it's fabulous! Come up with a 'hot' new item . . . and WHAM!

It strikes like a bolt of lightning!

Suddenly, you are deluged with cash orders from all over the country . . . MORE MONEY than you could ever make in a lifetime!

Like the Vermont dealer who ran one ad in Sports Afield Magazine. His ad pulled 22,000 orders—over A HALF MILLION DOLLARS IN CASH!

There is no other business where you can make a fortune so quickly!

- A beginner from Newark, N.J. ran his first small ad in House Beautiful—offering an auto clothes rack. Business Week reported that his ad brought in $5,000 in orders. By the end of his first year in Mail Order, he had grossed over $100,000!
- Another beginner—a lawyer from the midwest, sold an idea by mail to fishermen. Specialty Salesman Magazine reveals, "he made $70,000 the first three months!"

Proof

It's a fascinating business! Running ads in newspapers and magazines . . . mailing gift catalogs . . . getting cash orders in your daily mail—steady as clockwork.

There is no other business where you can start on a shoestring and pyramid your profits—*without investing in merchandise!* One husband and wife mail order team took in $40,000 selling one item. They obtained FREE ads in national magazines . . . didn't invest a cent in merchandise, and even got the supplier to ship all orders for them!

These exceptional cases are absolute proof that *you can get rich* in your own Mail Order business. Very rich. Even a U.S. Gov. Report stated: "A number of one-man Mail Order enterprises make up to $50,000!"

Pick up any magazine. Notice how the same mail order ads are repeated . . . month after month? That's concrete proof! You know those ads wouldn't be repeated over and over again—*unless* they were bringing in big cash profits to their owners.

The Secret

The secret of getting rich in Mail Order lies in *financial leverage*. It's a little-known, almost secret method—using other people's capital to make money for you!

You can get thousands of dollars worth of advertising in big national magazines—without investing your own money! And you don't have to write a single ad. Tested and proven ads are prepared for you by experts. Reinvest the profits from your first successful ad —to get more, larger ads, and the profits begin to snowball! It's like building a chain of stores . . . each new store puts more money in *your* pocket.

You mail out beautiful catalogs which offer hundreds of dollars worth of fine, quality gifts yet you don't invest one cent of *your* own money in merchandise! Your catalogs are printed with your name and address, so all orders come to you. Everything is "drop-shipped" for you, and there's up to *100% mark-up!* You pocket the cash profits immediately even before the orders are shipped to your customers!

The thrill of receiving money in your mail is one you'll never tire of!

Repeat orders alone, just from mailing catalogs, could bring you a steady income for the rest of your life!

Yes, Mail Order is the fastest-growing, most profitable business in America! And now, with more people moving to the suburbs . . . the population explosion . . . and the expanding teenage market . . . we are on the verge of the BIGGEST BOOM in Mail Order history!

Now, with the help and backing of Mail Order Associates, Inc., of Montvale, N.J., you can follow the same proven steps to Mail Order success—using the 'secret' of financial leverage!

Start Now

We supply you with beautiful gift catalogs throughout the year. All products are drop-shipped for you, with up to 100% mark-up! You get free samples of top-selling mail order items, plus monthly trade reports on 'hot' new products . . . tested, successful ads are sent to you monthly. You get advertising directories, postal laws, complete courses, expert guidance EVERYTHING you need to practically guarantee YOUR SUCCESS. Why? Because *our* business depends upon *your* success. It's mutually profitable!

A recent feature article in Income Opportunities Magazine stated, "Mail Order Associates Inc., offers the most comprehensive Mail Order program ever offered to beginners." They go on to say, "This could be the opportunity you've been looking for. A chance to get in on the ground floor in a little-known business which we believe is on the verge of a new boom."

Free

We are now accepting a limited number of charter members in our new Mail Order Program. No previous experience is required but you must be over 21.

If you are sincerely interested in starting a profitable business of your own . . . if you can see the tremendous advantages which Mail Order offers . . . then ACT NOW!

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will send you a free book gift catalog, reprints of feature articles, plus complete facts about our program. Write to:

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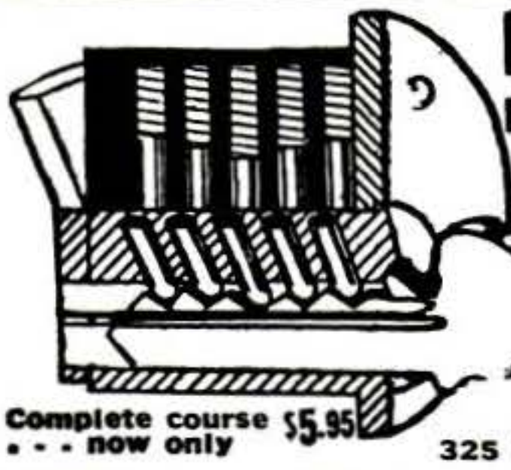

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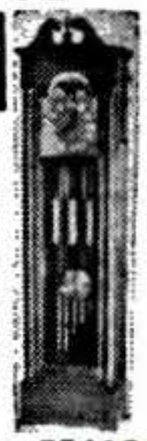

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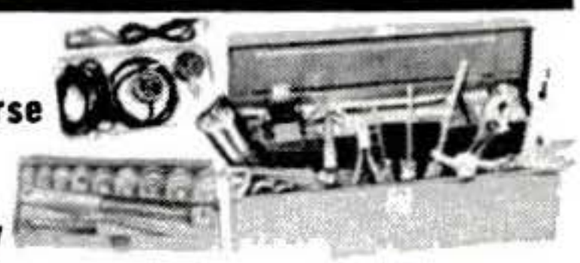

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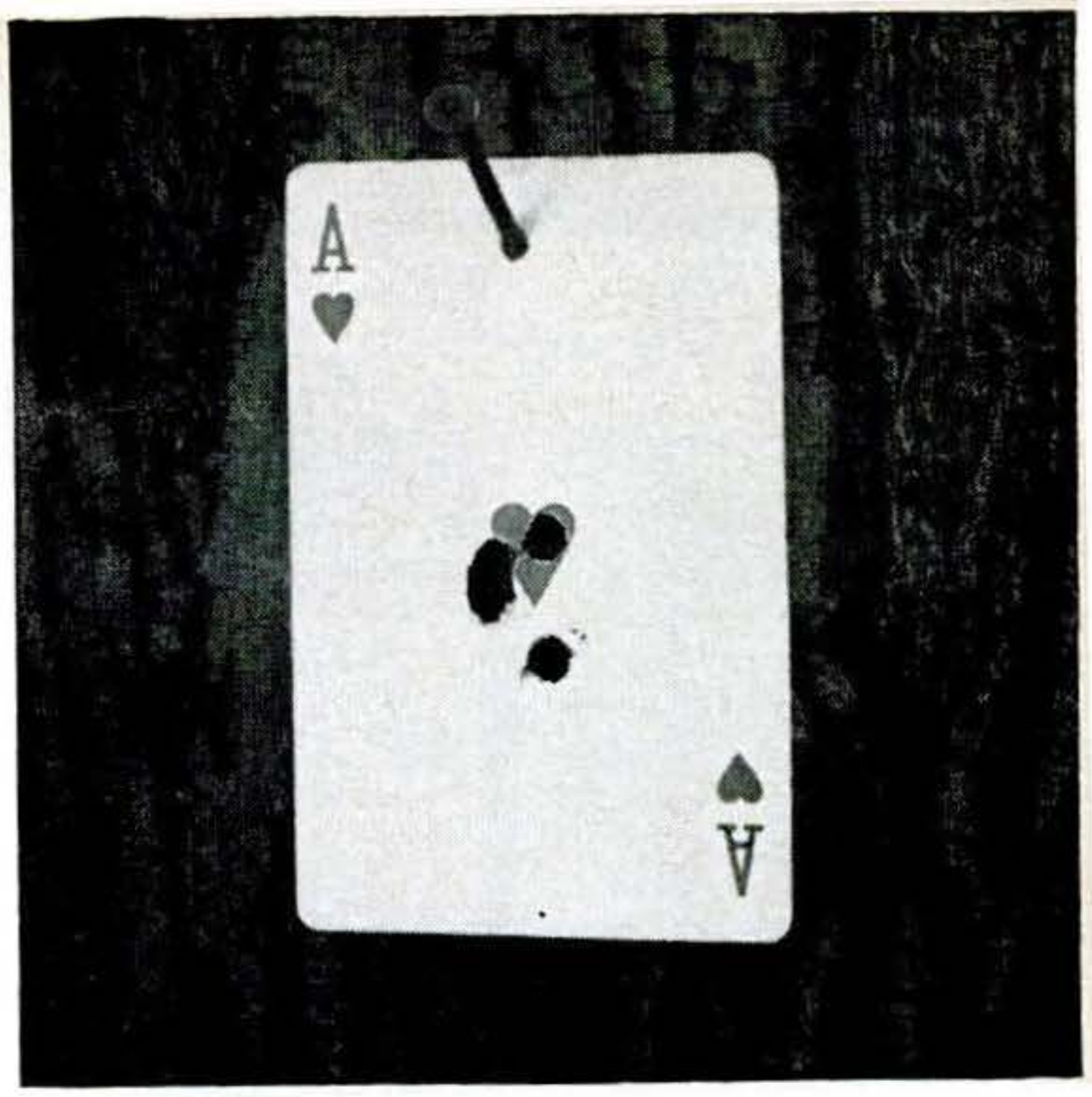

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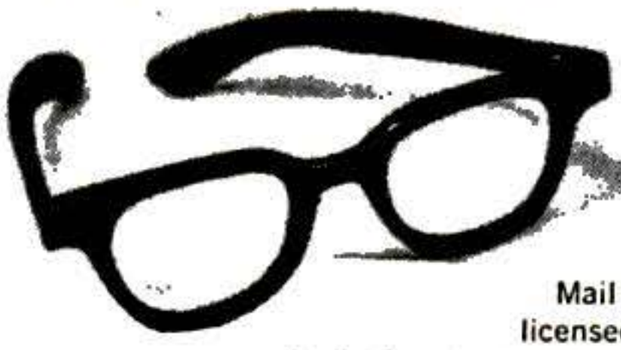

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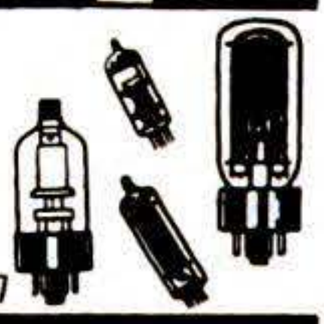

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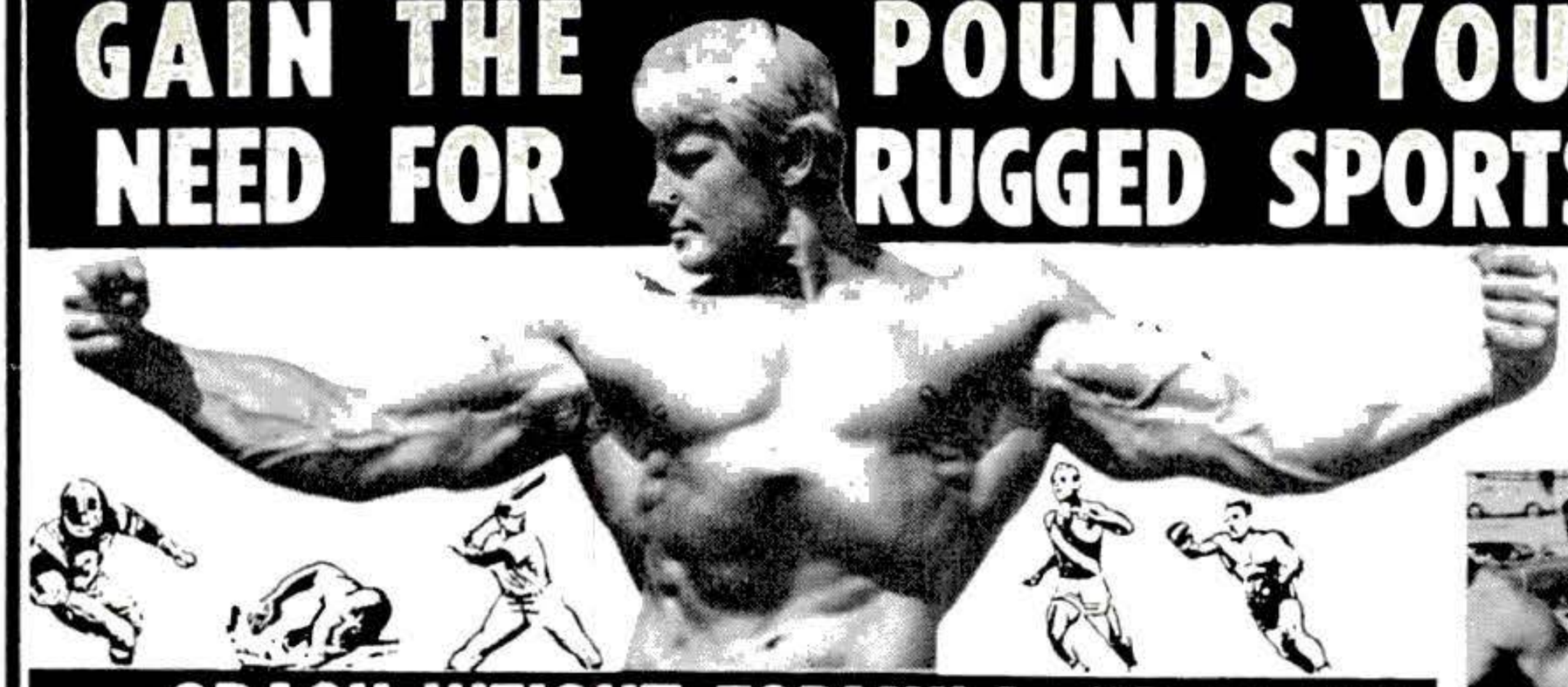

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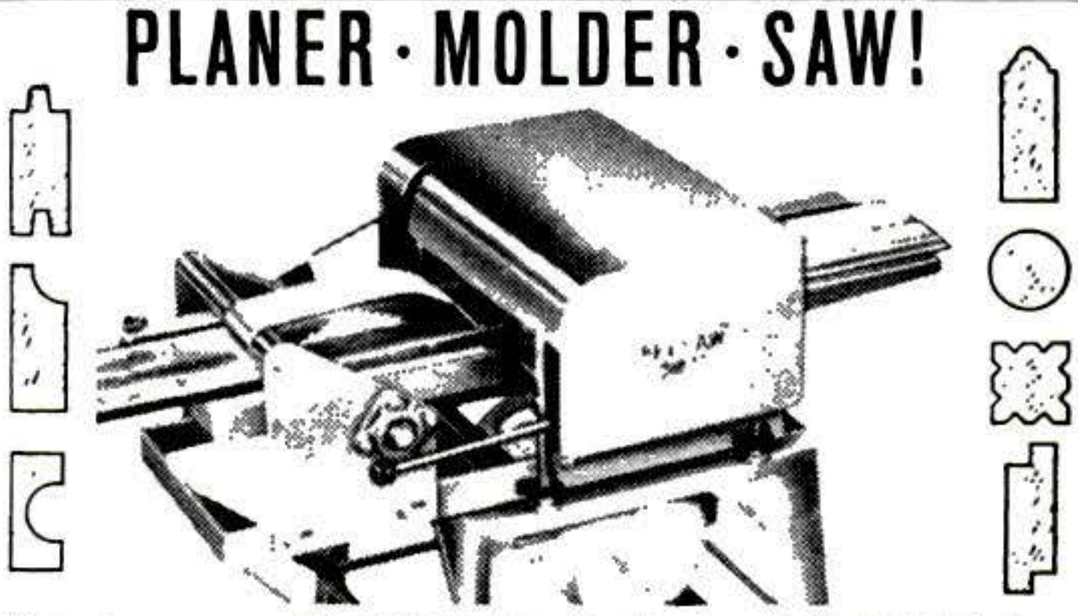

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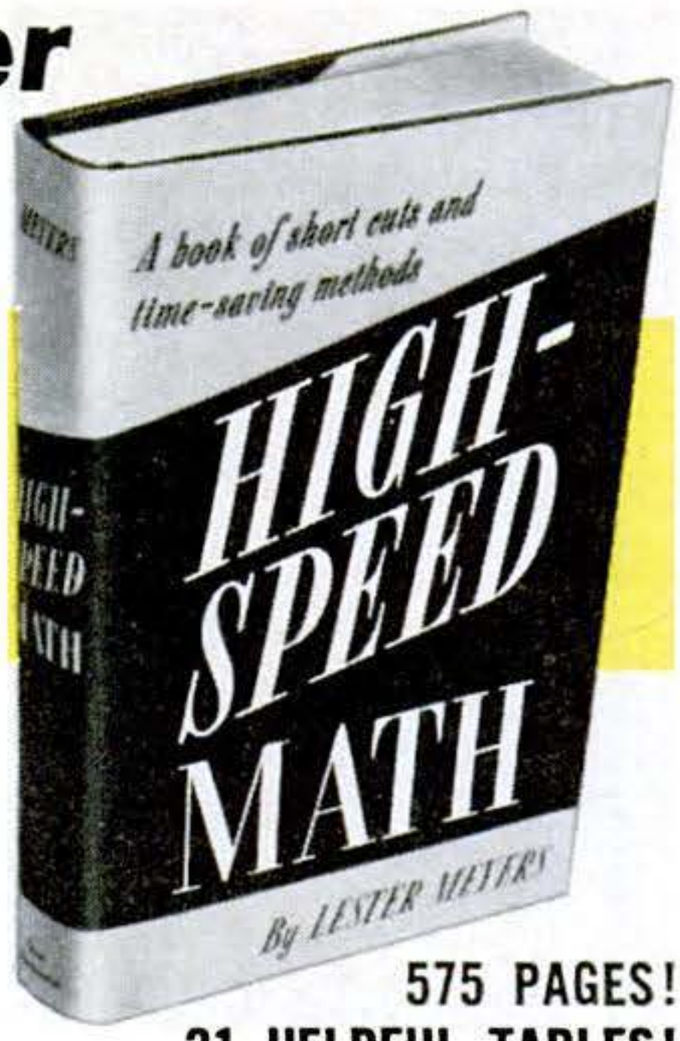

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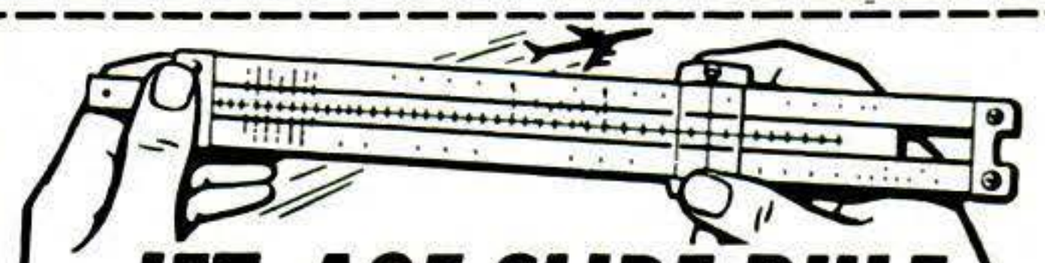

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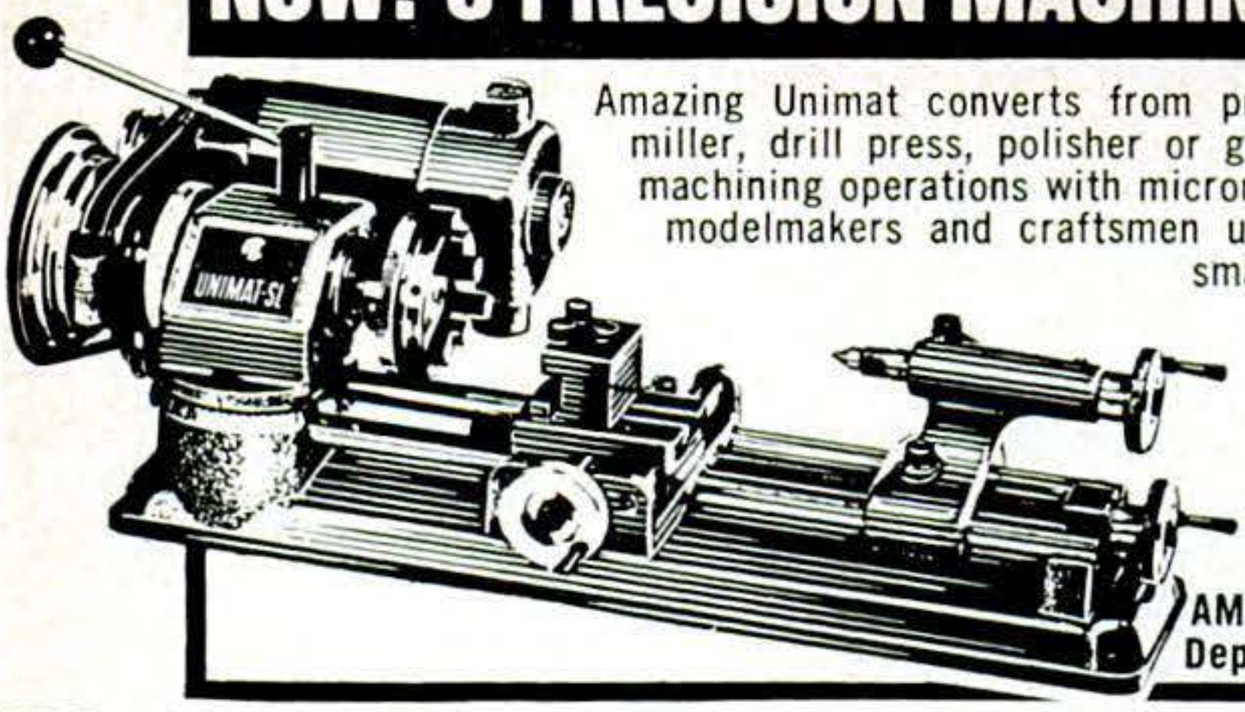

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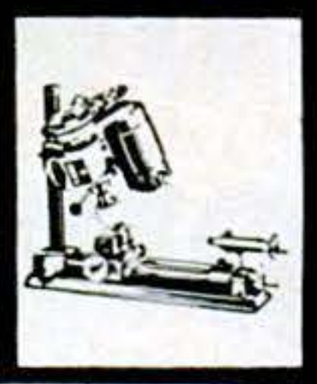

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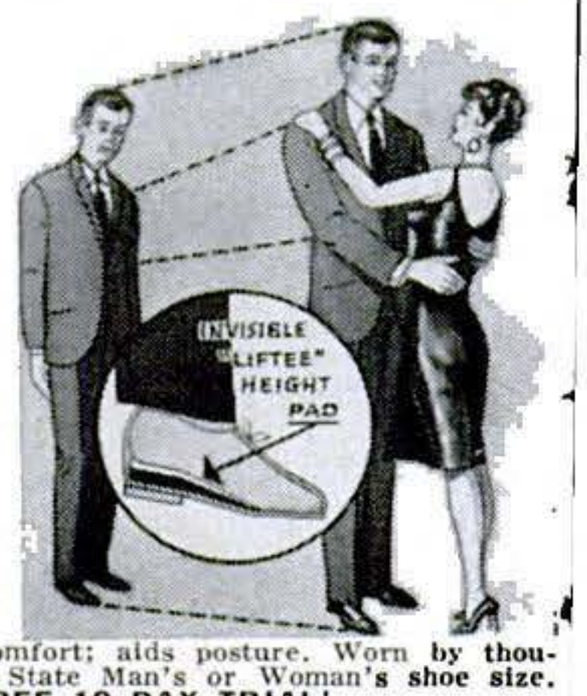

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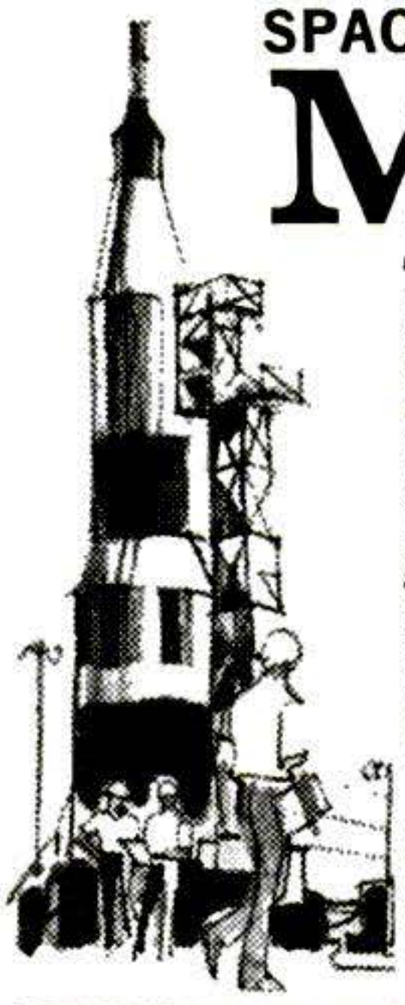

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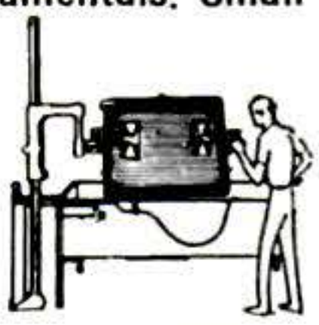

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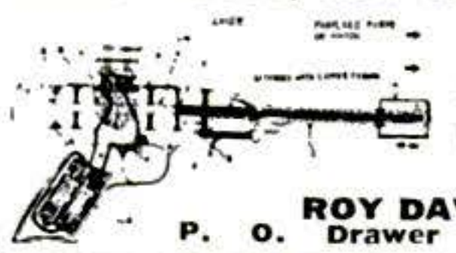

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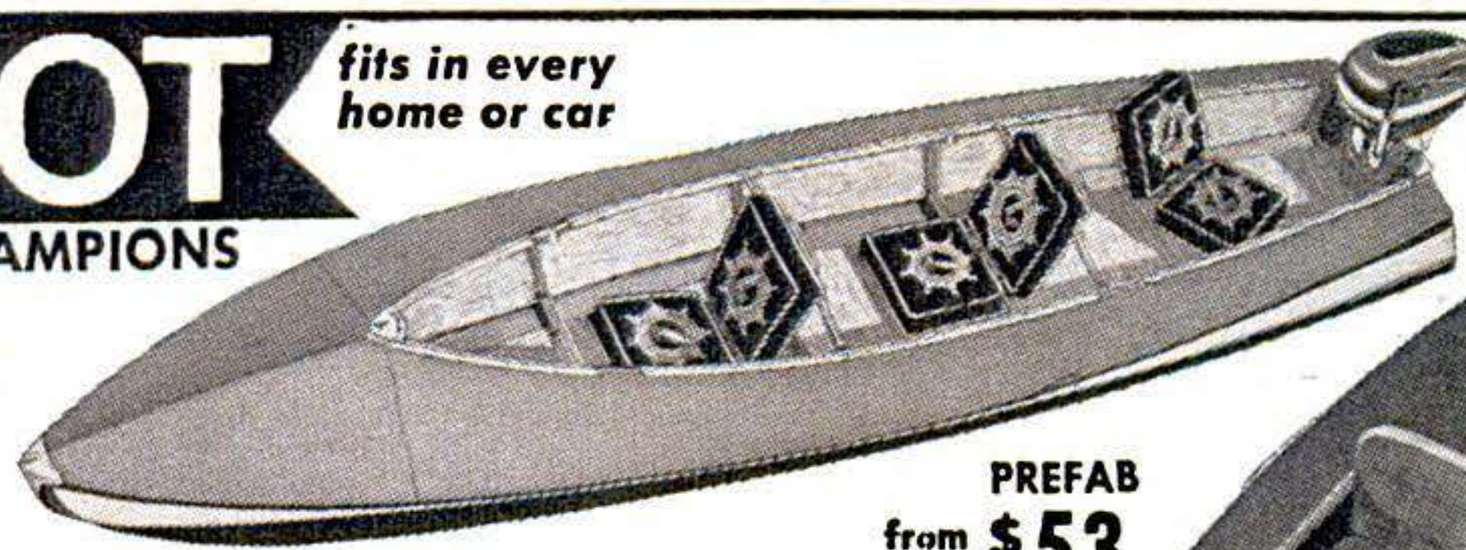

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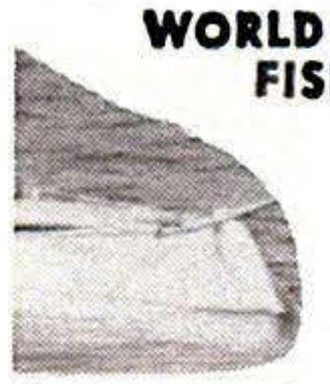

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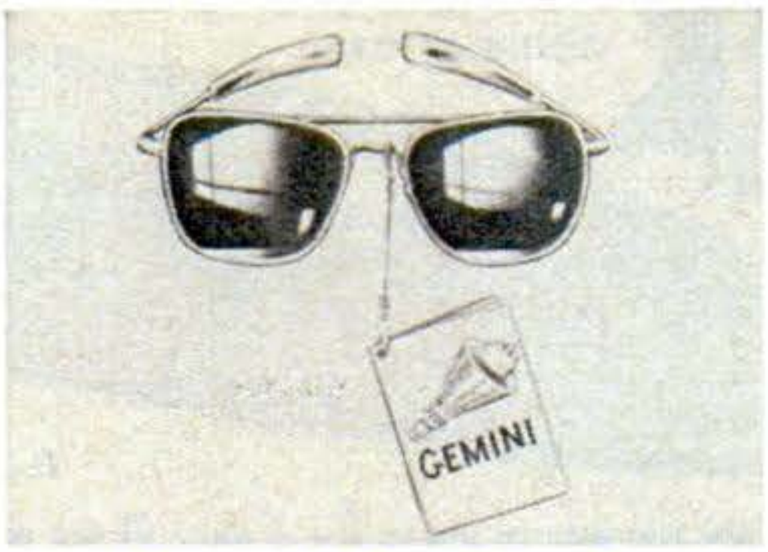

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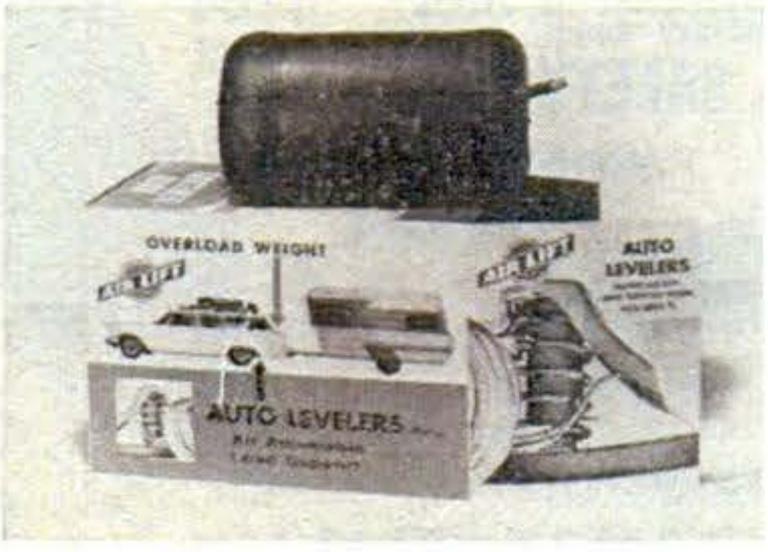

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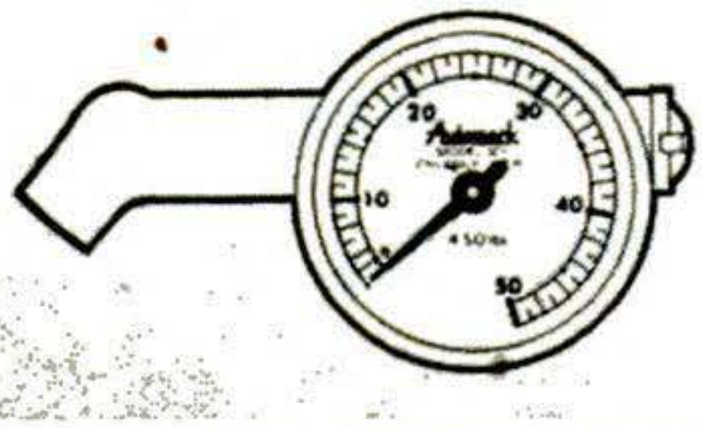

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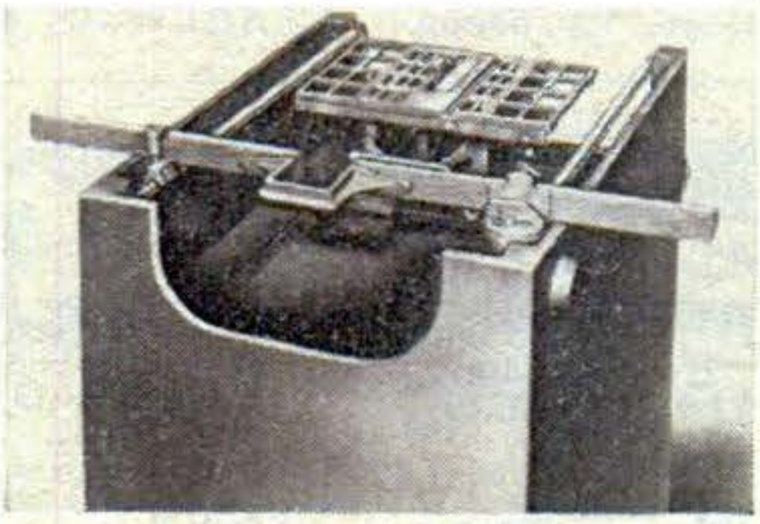

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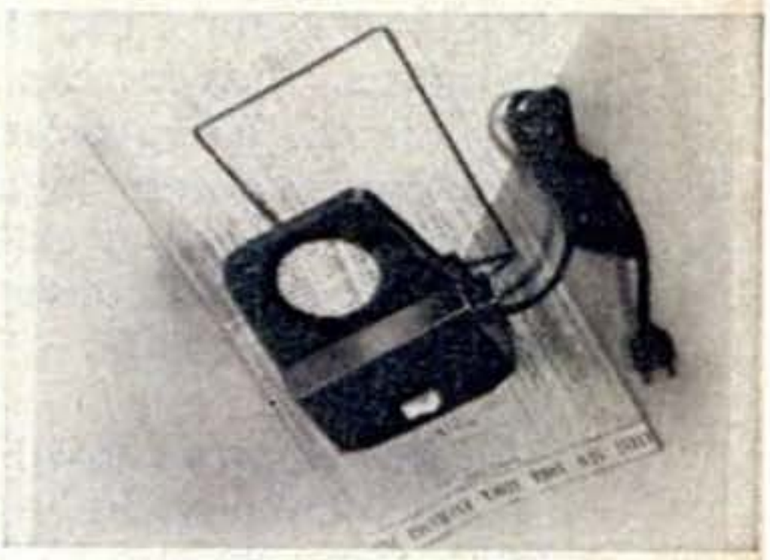

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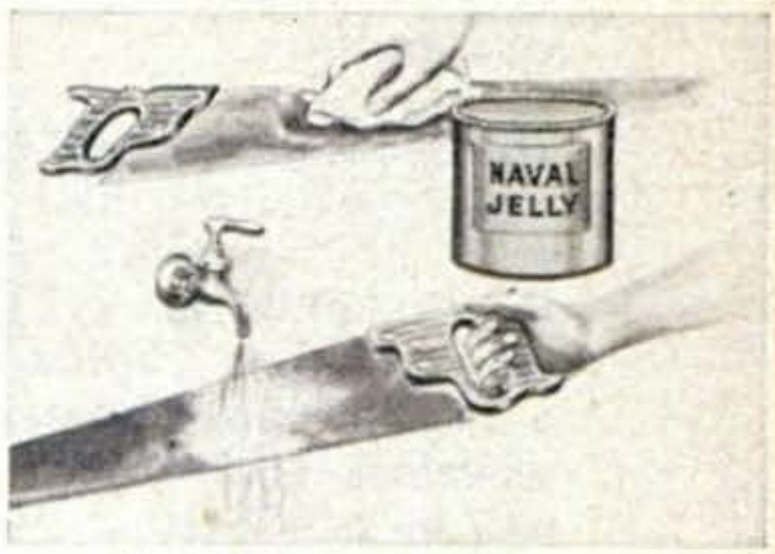

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A SUBCOMPACT CHEVROLET IS A DISTINCT POSSIB
its Delta project (see last month's "D
Chevrolet won't let Ford get the jump on
Chevrolet's general manager, left no do
when he told me recently: "Sure we need
rally, Chrysler engineers are working o
sibly drawing on experience from the Si
which produces subcompacts in France an

Price may be the roadblock holding up U.S. subcompacts. Prototypes are being designed, but there is no assurance they'll go into production. There is doubt that any American company can compete with imports priced under $2,000. Why? One of Detroit's hang-ups is need for a car that can be loaded with options so buyers can "upgrade." Low-cost designs are compromised to enable an economy car to accept bigger engines, automatic transmissions, power steering and brakes, plus luxury and convenience options Detroit sells in larger cars.

The AMX sports car will bow in at the Chicago Auto Show next February, along with a new 390-cu.-in. 325-hp. V-8 that will be made available on all American Motors cars. The AMX will be a two-seater, and styling will borrow heavily from the Javelin [see page 99]. It will have its own grille, however, and a unique tail. With a long hood and fastback roof styling, the AMX will look more like a European sports car than anything now made in America. It will be priced well below the Chevrolet Corvette, its only direct competitor.

The debut of the Mark III is planned for January—at Cartier's, the world-famous jewelry store in New York. Insiders say Lincoln"s Continental Mark III will sell for as much as $100 less than Cadillac's Eldorado. Built on a Thunderbird frame, it will have a 120-inch wheelbase (like the Eldorado). The engine will be a 462-cu.-in. version of the new 429 V-8 in the Thunderbird. Horsepower will nearly match the Eldorado's 375. Only a two-door coupe is planned for the Mark III (no four-door or convertible bodies).

An electronic transmission on a Chevrolet? One report says that an electronically controlled automatic transmission will be offered in Chevrolet passenger cars in 1971 in a test-marketing program. Solid-state electronic units are
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but is nov
cent of new cars were medium blue, 12.5 p
cent, white. Black continues to lose favor; preferred by 13 percent in 1958, it dropped to only four percent in 1966.

The rubber bumper on Pontiac's GTO is expected to spread across the whole Pontiac range in a few years. It will probably also be copied by other auto makers. American Motors, Ford, and Chrysler will have a problem: the difference in paint. All GM divisions use a lacquer, dried in ovens with temperatures well below the melting point of the rubber material. But the other auto makers use enamel paint, and oven temperatures can change the shape of the bumpers.

Jim Dunne

Detroit Editor

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1968 BETTER IDEAS FROM FORD THE WAGONMASTER

The beginning of our 1968 Better Ideas story starts at the end—the rear end of our wagons—where you'll find the famous Ford Magic Doorgate. Ingenious, special hinges permit the Doorgate to swing out just like a door or swing down like a tailgate.

When you operate the handle at the right side, the Doorgate opens as a door for safer, easier passenger entry to the third seat and easy "close-in" loading of heavy objects.

Pressing the center latch operates the Doorgate as a conventional tailgate, and swings it down to support long, bulky loads like lumber or ladders.

Magic Doorgates are available on all 12 wagons from Ford for 1968 (standard on Fords, Torino and Fairlanes, optional at moderate cost on Falcons).

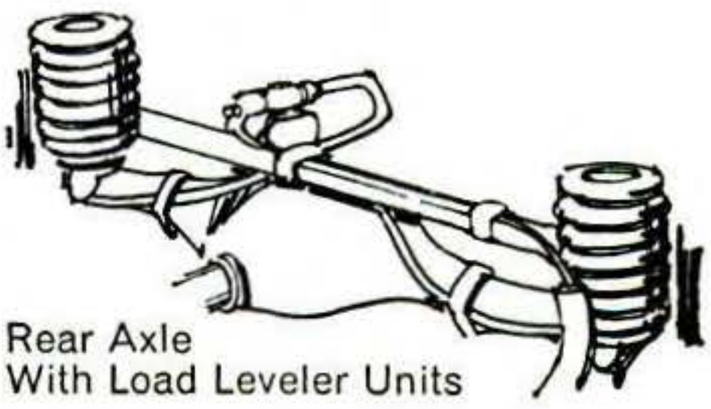
Dual-facing rear seats are another Ford Better Idea. They enable you to seat additional passengers in the rear of Ford wagons.

For those who really put their wagons to work, we've made the load floor of Ford wagons long enough and wide enough to carry full 4 x 8-foot sheets of plywood.

Other Better Ideas—a lockable stowage compartment concealed beneath the deck of the rear compartment is standard on Ford, Torino and Fairlane wagons. Also, for less than $30 you can order Torino or Fairlane wagons with removable cushions that turn this compartment into a rear-facing seat that accommodates two additional passengers.

Ford wagons tailor the power to the job, too. Choose from as many as six different engines on Ford, Torino, Fairlane or Falcon wagons, ranging from lively 200- or 240-cu. in. Sixes through the efficient new 302-cu. in. regular gas V-8, to the mighty Thunderbird 390-cu. in. V-8. You can team any of them, with either SelectShift manual and automatic, or Synchro-Smooth 3-speed manual transmission.

Ford's optional load leveler is especially useful on wagons where the load can quickly change from just a driver to an extra heavy load. The load leveler keeps your Ford on an even keel and gives you a comfortable ride regardless of the weight of the load. The load leveler is twice as helpful if you pull a heavy trailer. It compensates for the extra weight of the trailer



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With Load Leveler Units

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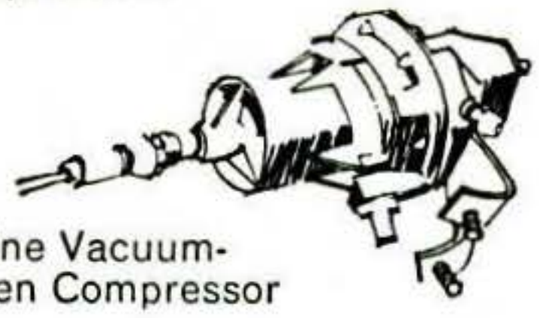

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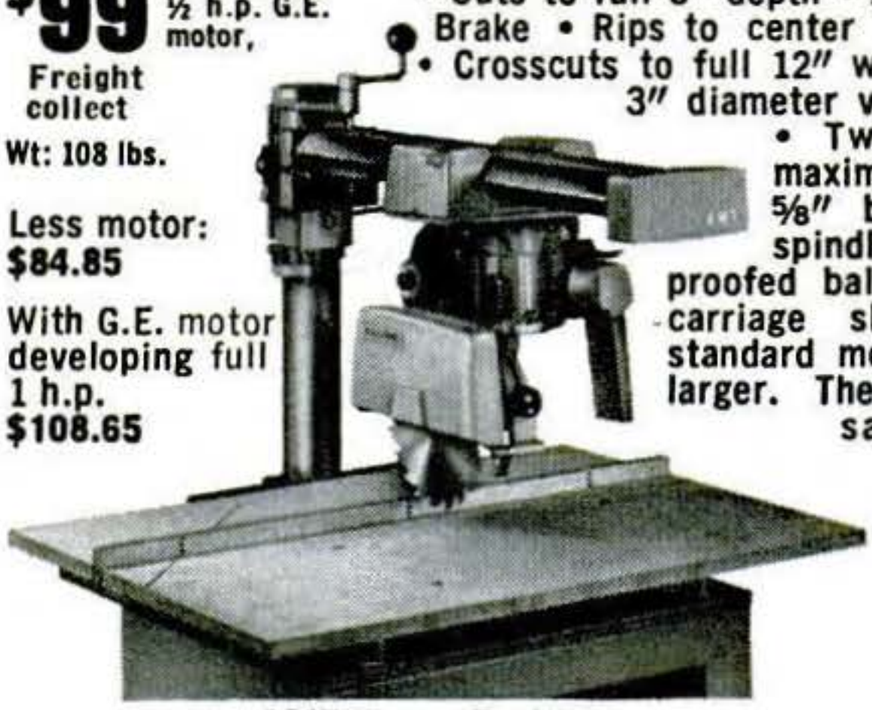

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Exercise bike has mileage counter

A new bike that goes like mad standing still can provide exercise for the housewife. It has not only a mileage dial, but a wheel-tension caliper as well to simulate hills. Made by AMF Whitley and called the Trim Ride 600, it is being demonstrated here by an exceptionally pretty girl named Barbara Raaber.

The Galloping Goose is back

In 1931, seven single-car "trains" were built, powered by Pierce Arrow engines, for a 172-mile route of the Rio Grande Southern. Each was called "The Galloping Goose." Twenty years later the line was abandoned. Now Dolores, Colo., buffs have rebuilt one as a tourist lure. It does its chugging along a mile of track.

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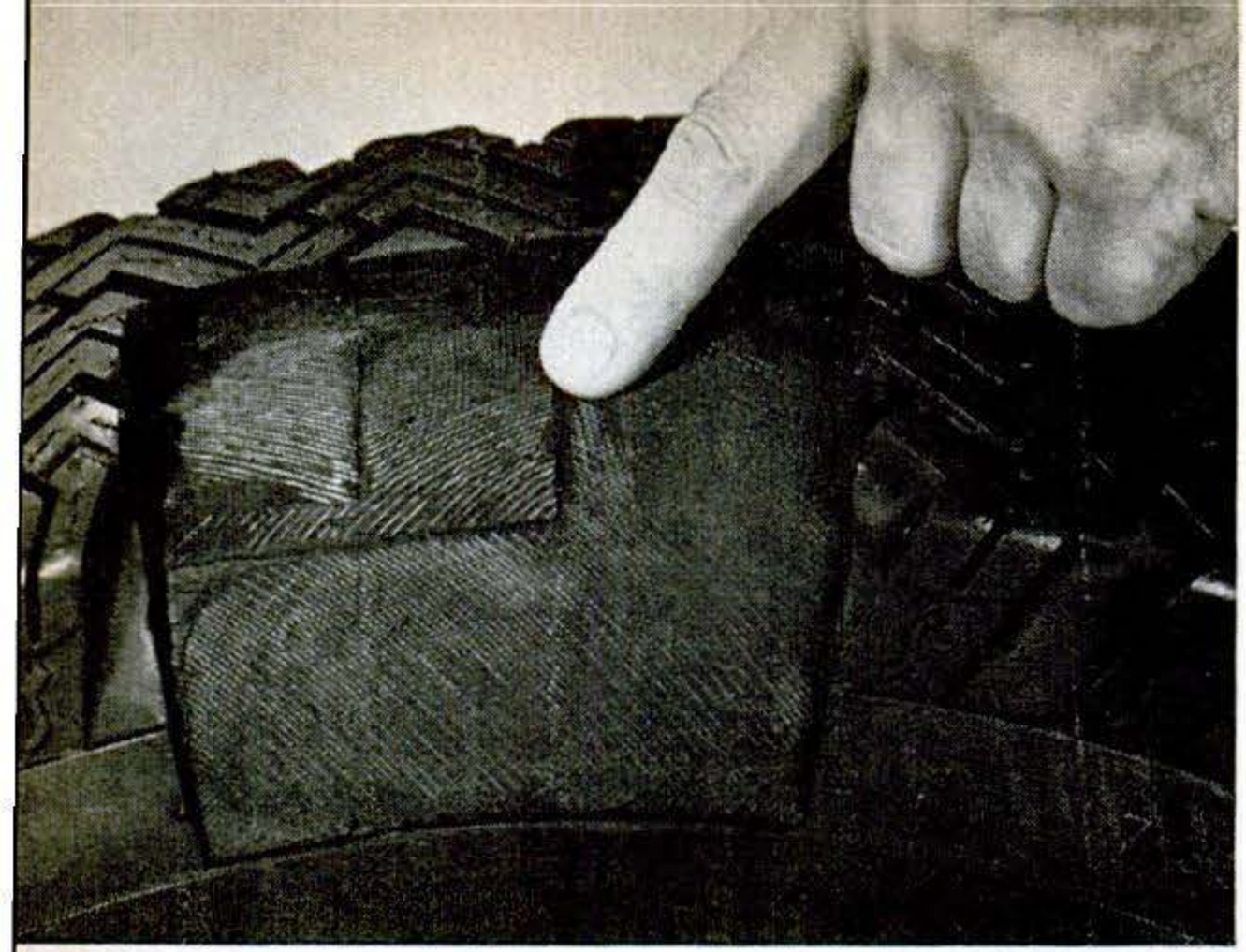
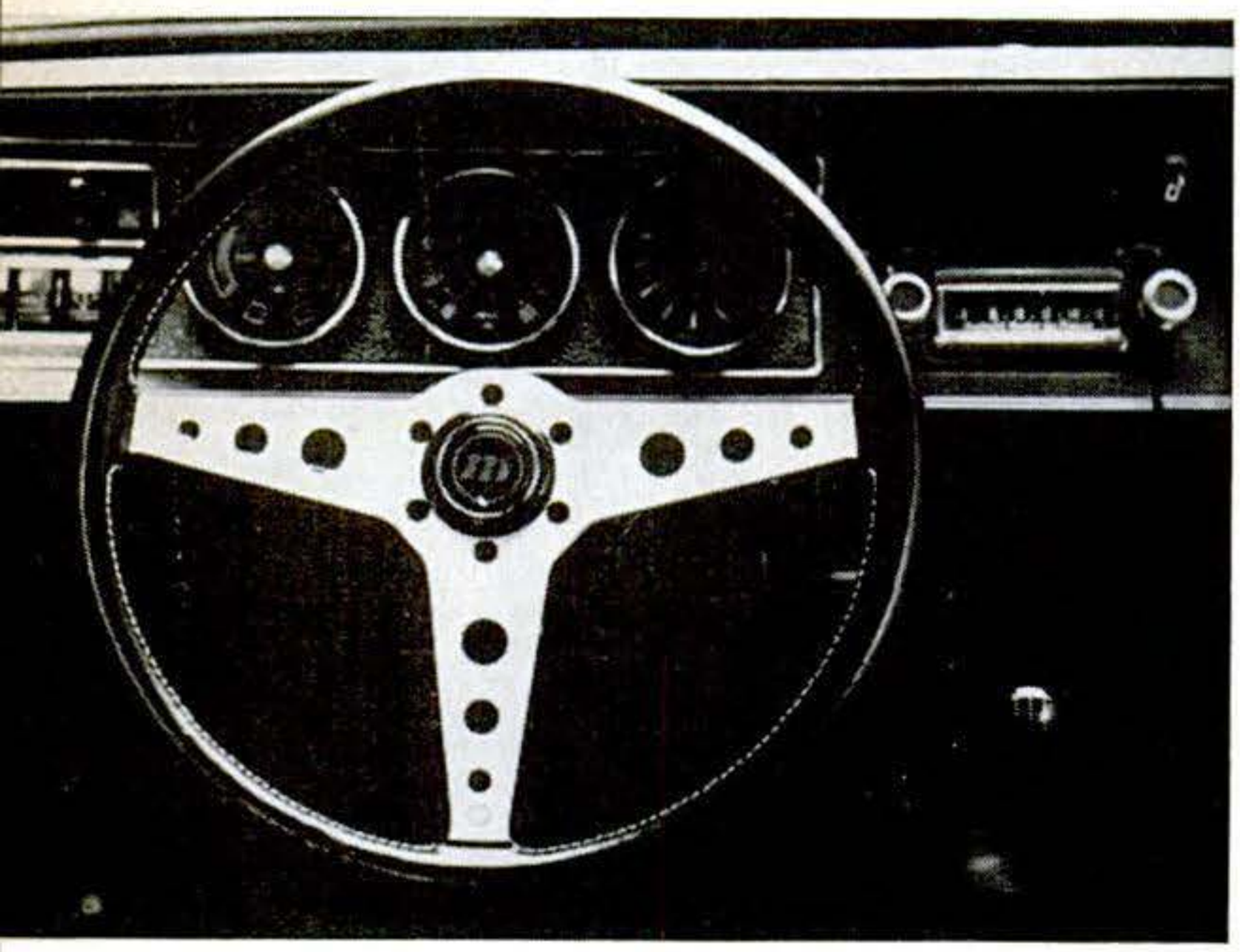


Fiberglass-belted tire for mud or snow

Here's a new Sears, Roebuck mud-and-snow tire with fiberglass belting under the tread and normal cross-bias ply construction. Tests showed tread wear of about 50 percent after 16,000 miles under conditions in which conventional tires would be completely worn out. There's a choice of black or white sidewalls. Prices of 6.50x13 blackwalls start at $20; with studs, at $27.

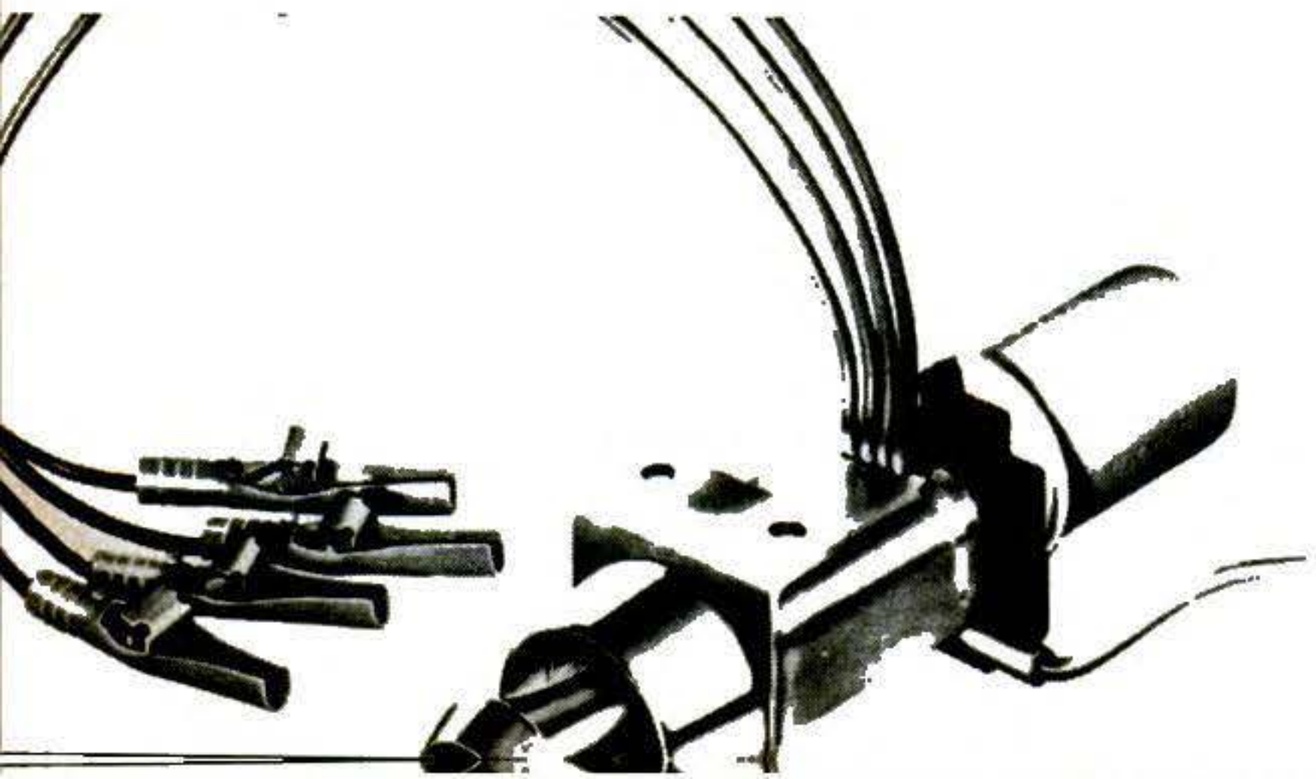
High-quality replacement pads for disk brakes

Tempted by a bargain in brake pads? Stay away from it. Low-priced brake pads mean poor quality and short life. Johns-Manville, suppliers of friction pads to most U.S. disk-brake manufacturers, is now offering to car owners a line of high-quality pads. These are made of the same asbestos-based material they developed in cooperation with Detroit's brake engineers. You can buy the pads from your local J-M distributor.



A genuine racing-type steering wheel

The Real Wheel (factory equipment on many Ferrari, Lancia, and Alfa Romeo models) is now available for Mustang, Corvair, Corvette, and all popular sports and imported cars. The grippable foam-cushioned 15-inch rim (at left in an Opel wagon) is sheathed with glove leather. Spokes are anodized light alloy, buffed for glare resistance. Cost: from $54.95. Formula One Enterprises, 37 W. 57th St., NYC 10019.



Four-way flasher for older cars

This simple conversion kit, similar to the emergency warning-light system on '67 cars, is easily installed on older ones, with no cutting, stripping, splicing, or taping of wire. It operates on its own circuit and cannot overload the existing signal-light system. The unit meets SAE and state requirements. For six- or 12-volt systems. $5.25. J. C. Whitney & Co., 1917 Archer Ave., Chicago 60616.

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You're like a kid with a new sled.

Forget all your ideas about winter driving! Join the 'Jeepster' crowd, and show winter who's boss. Flip a lever —at any speed—and you're in 'Jeep' 4-wheel drive. Sit back in those bucket seats, and *go!* This baby really loves the deep stuff! Choose the 'Jeepster Commando' Station Wagon or the 'Jeepster' Convertible with continental spare. 4-wheel drive and 4-cylinder engine are standard on all models. Add sporty options like husky V-6 with (or without) Turbo Hydra-Matic* automatic transmission; sports console; power brakes; air conditioning. There's also a jaunty Roadster model. And a snappy Pick-up. All smooth performers on the road...all tougher than nails in the rough. **Holy Toledo...what a car!** You've got to drive it to believe it. See your 'Jeep' dealer for a test drive. Check the Yellow Pages.

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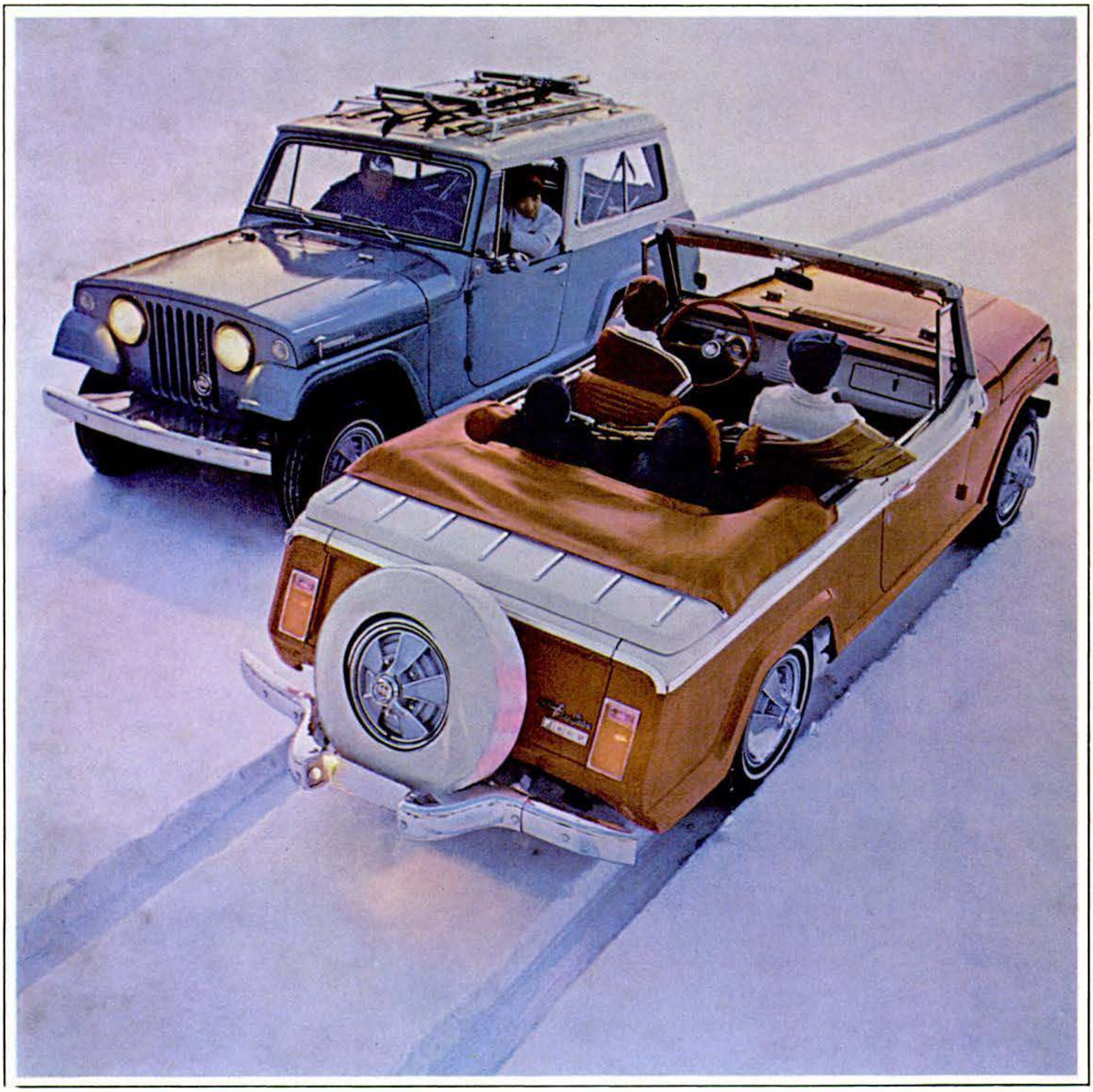

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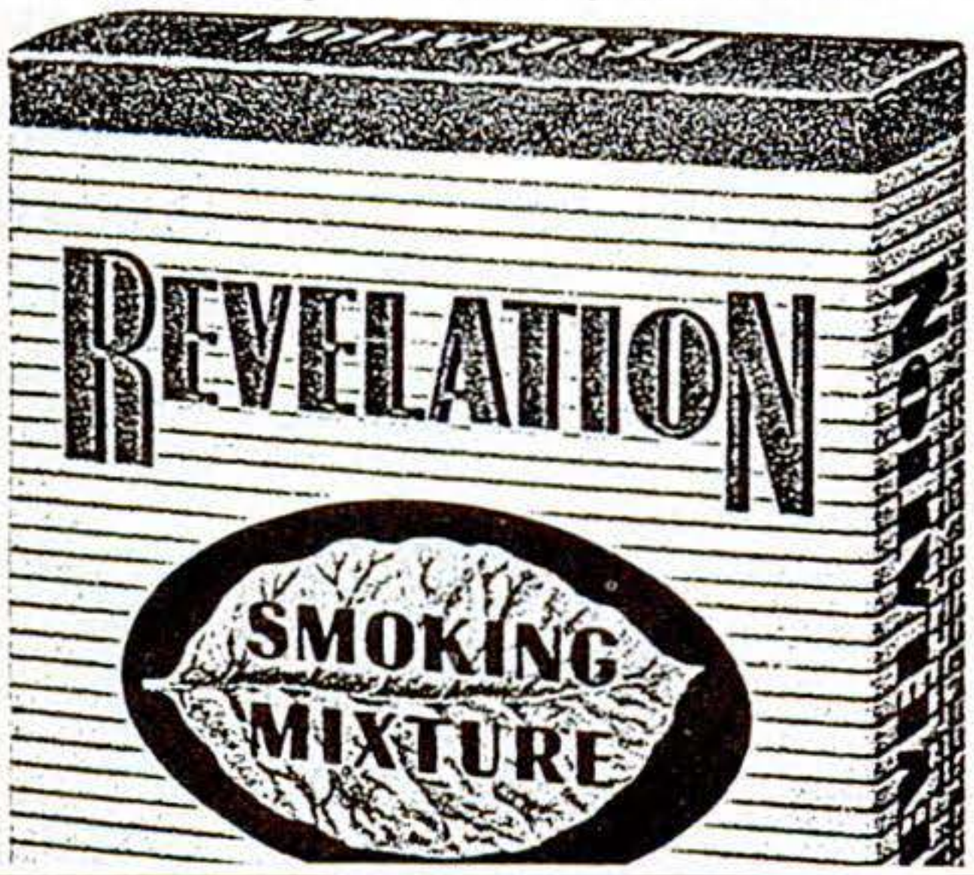

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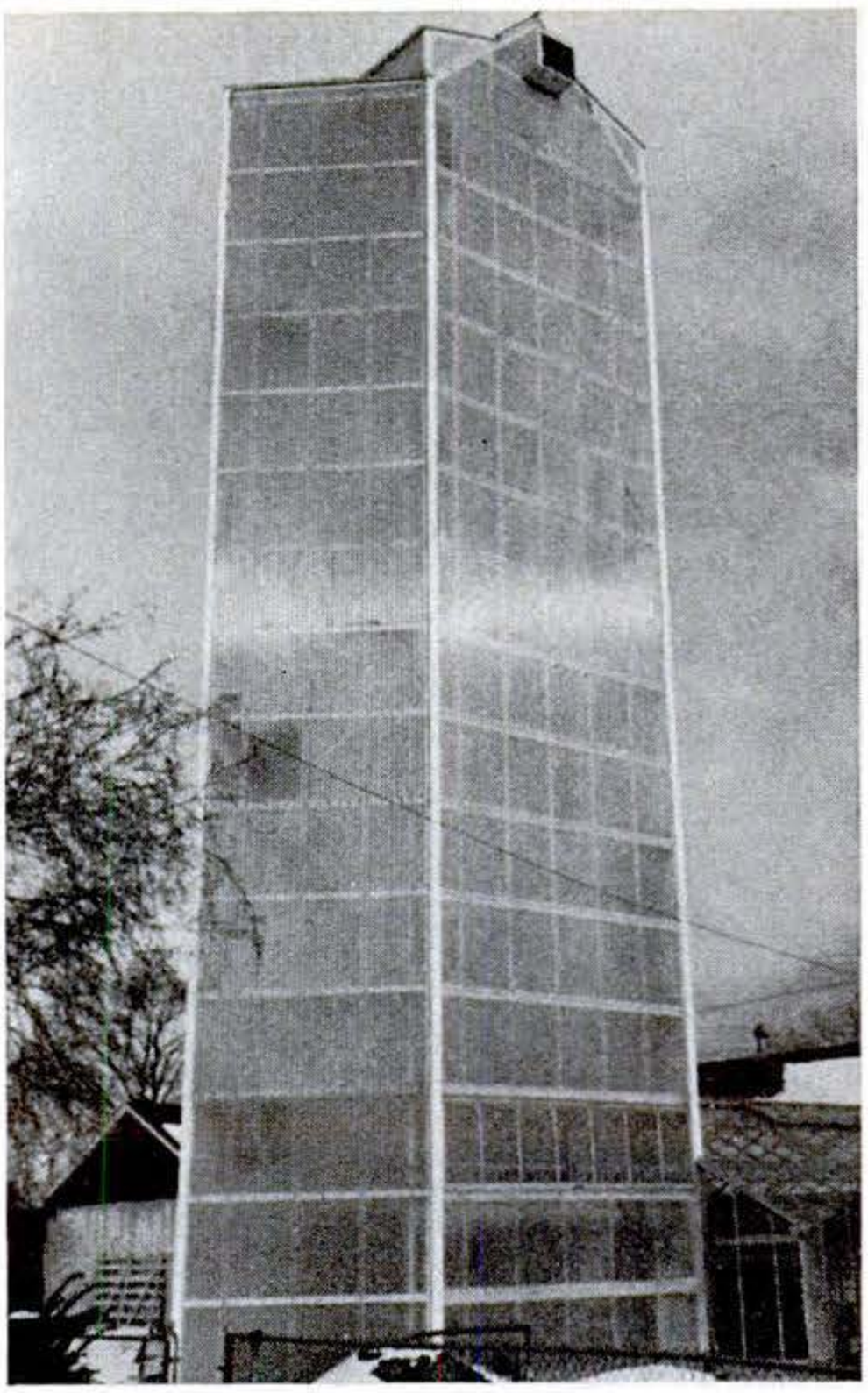

A green thumb shoots skyward

The structure above isn't an apartment house or a vertical garage. You'd never guess, so we'll tell you. It's a greenhouse, in Toronto, reputed to be the first vertical one in North America. It has motorized frames that carry the plants up and down for proper sunning in all seasons.

Going abroad? Be your own cabbie

Paris has a new idea in taxis for tourists—you rent one and drive it yourself. The taxis are British-made Mini-Mokes, and cost $3 an hour, but that's only incidental. What really sends you is the tape machine that goes with them, describing the sights that you shouldn't miss.

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Return of The Great One

Pontiac Motor Division

Pontiac GTO. New inside. New outside. New wider Wide-Track. New unique bumper that's the same color as the car, won't fade or corrode and it's virtually ding-proof. New disappearing windshield wipers. New twin-scooped hood. New extra-cost hideaway headlights. New padded dash with wood-grain styled paneling. 13 new exterior colors. New 350-hp Quadra-Power 400. New carburetor air preheater. New padded windshield corner posts. And you can order a 360 hp 400 or the 360-hp Ram Air that turns those hood scoops into the real thing. Hardtop or convertible. The Great One is back. Aren't you glad you waited?

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68 Pontiac GTO

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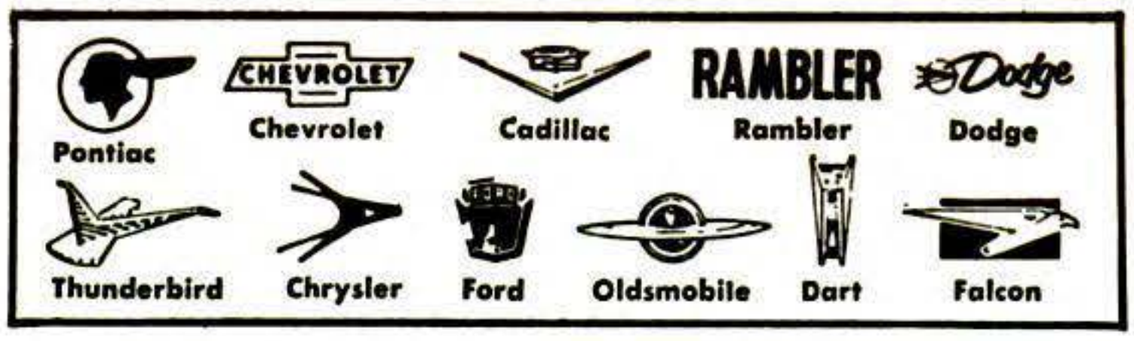

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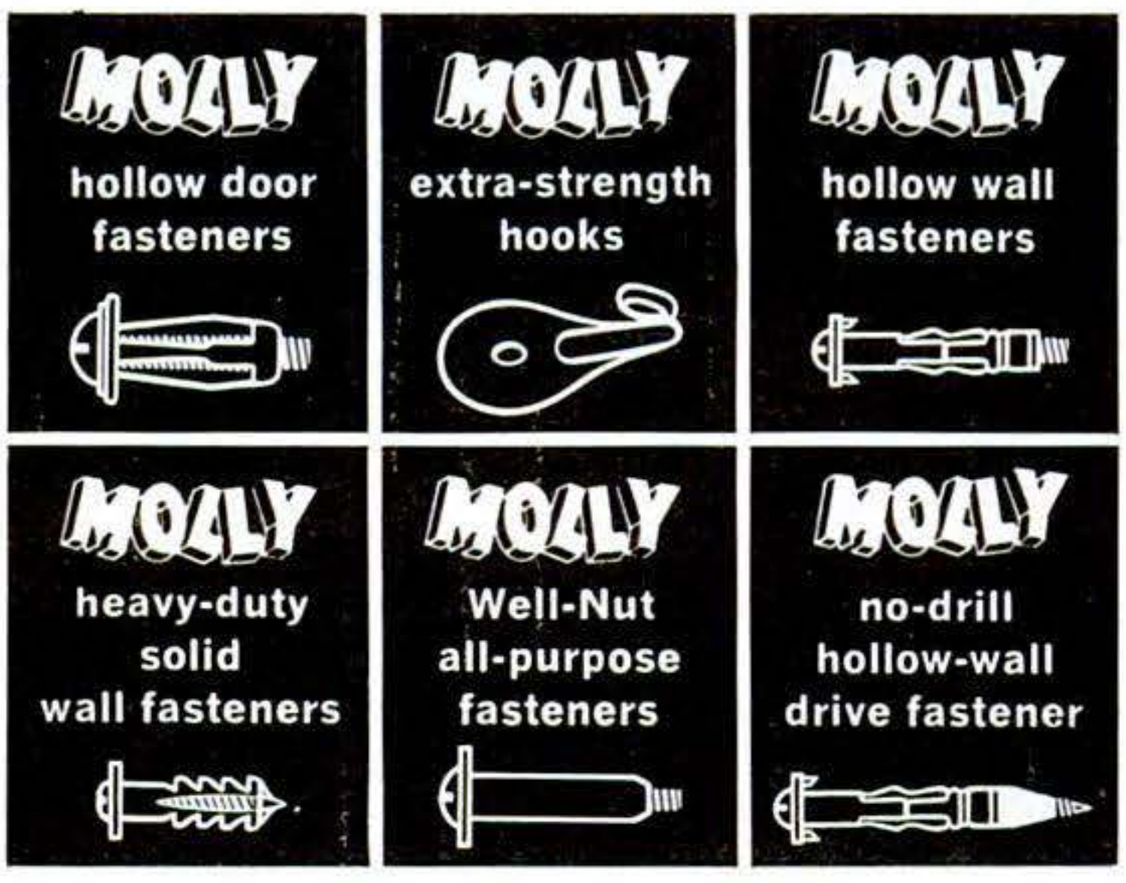

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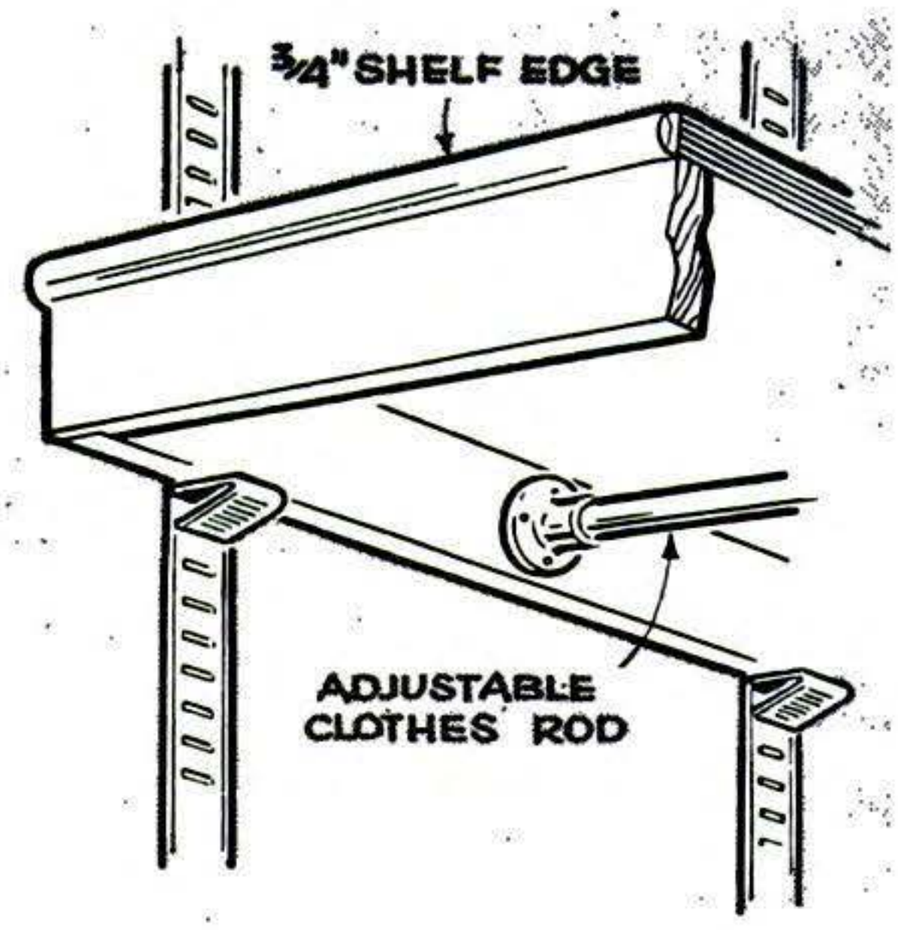
Caulking keeps sand under the patio

I laid my slate patio on sand and had problems. Sand kept coming up through the joints, a city of ants moved in, and the children tracked sand into the pool. By caulking the cracks, all the problems were eliminated. The caulking stays pliable, but not sticky, and the patio is easy to maintain with an occasional sweeping.

J. PAYNE, Franklin Lakes, N.J.



Closet that grows with the child

Build your child's closet shelf on a frame to which the clothes bar is attached. Use four pilaster strips; when it's time to raise the clothes, you just move your clips. No carpentry.

J. GAYNOR, Seaford, N.Y.

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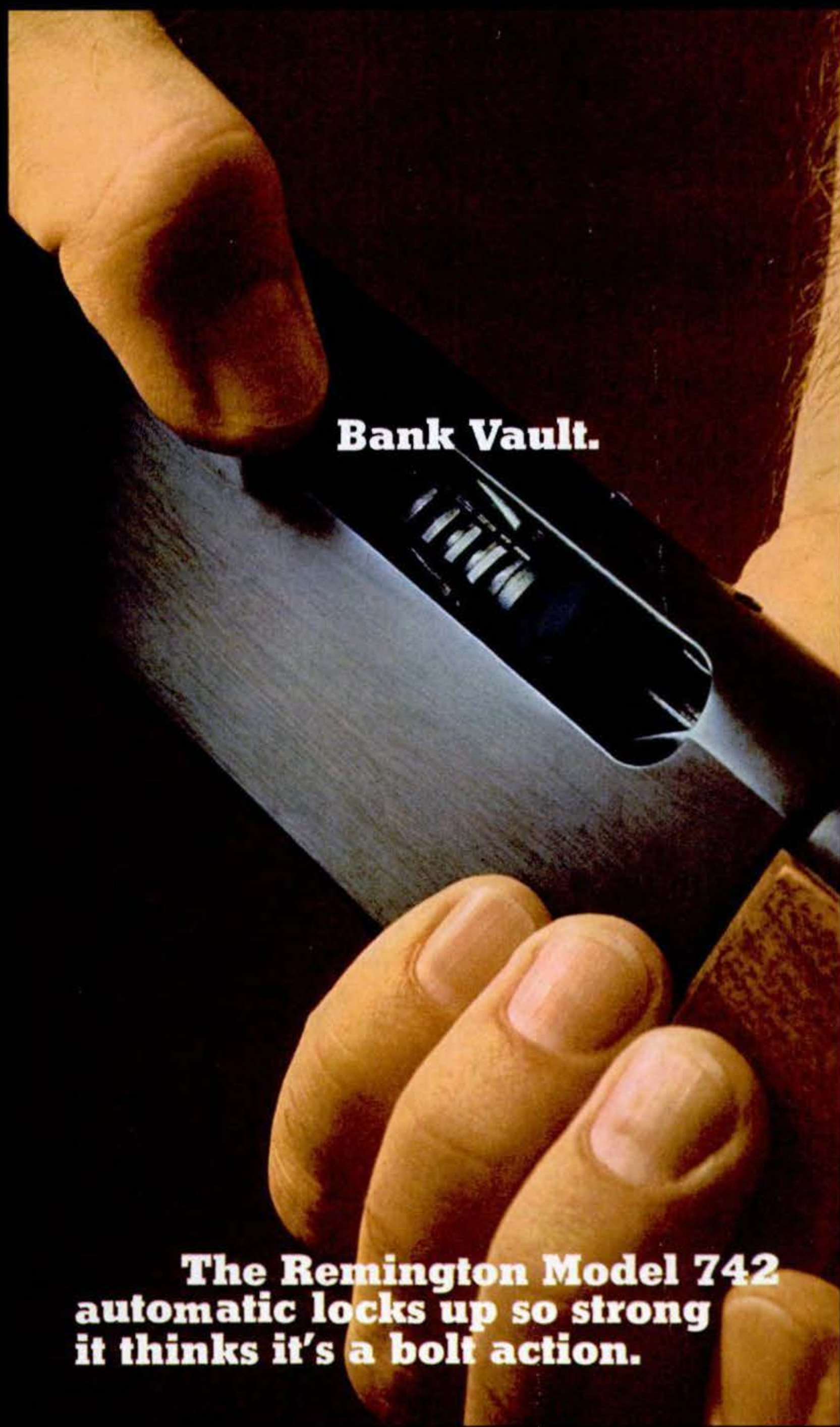

The 30/06 is supposed to be strictly a bolt-action cartridge.

But a Remington Model 742 automatic handles it with ease.

It's no surprise to us. A 742 locks up stronger than many bolt actions. That's why w can chamber it for such big sh as the 30/06, 280, 308 and 6mm And why it's one of the most accurate big-game automatics.

How do you build this kind of muscle into an automatic?

We gave the 742 a solid steel receiver. We designed the action so that when the bolt is closed, the cartridge head is protected by three rings of steel.

Then, we added a modern, dependable system of gas operation that cuts "kick" without cutting power.

Check around. You can buy other automatics. But the Remington Model 742 is like money in the bank.

From $159.95*.

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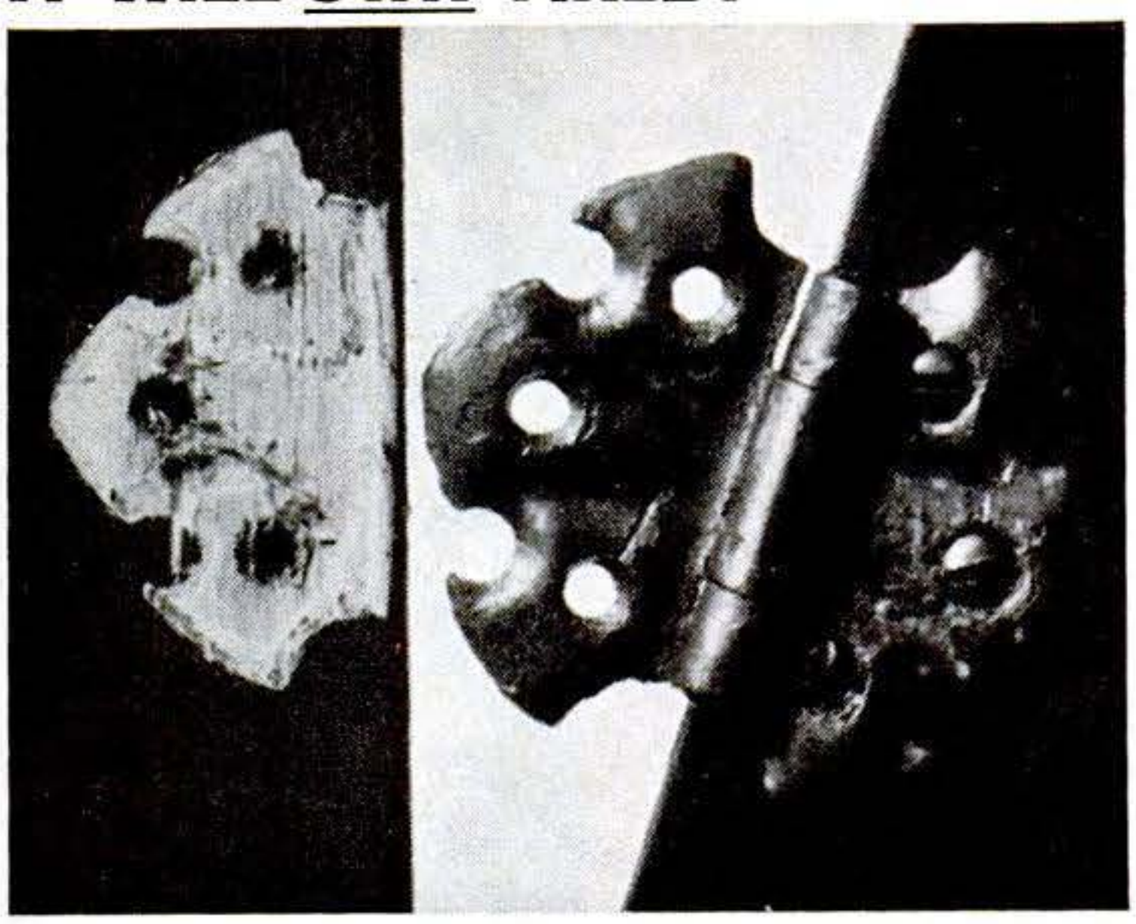


That loose hinge will stay put, when you use the great little fixer-upper: PLASTIC WOOD. It's *the* way to fix anything made of wood...because when it hardens, it's just like wood. Handles easy as putty. Does a "pro" job on busted furniture, loose screws, filling nicks, gouges—you name it! Great outdoors... resists weather. 5 colors, so you can match the job you're working on. Don't be without PLASTIC WOOD!

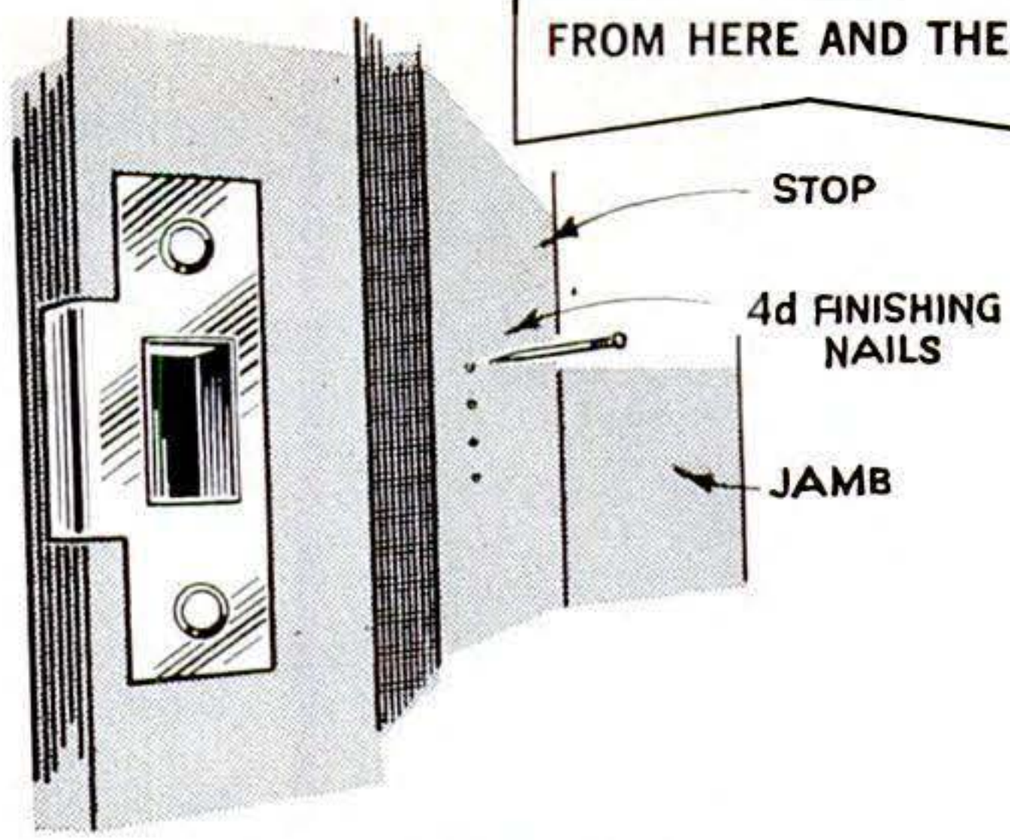
A repairman can cost $15 a shot.

3-IN-ONE® costs 1¢ a shot.

You can head off many unnecessary repair bills, with a few drops of 3-IN-ONE Oil! Cuts down wear on moving parts...things last longer. Also 3-IN-ONE can keep rust from getting started. When you spend good money for a sewing machine, power drill, bike, etc....shouldn't you spend a few cents to protect them? Regular. Electric motor oil. Or handy new spray can. 3-IN-ONE... it's wise insurance.

SHORT CUTS AND TIPS

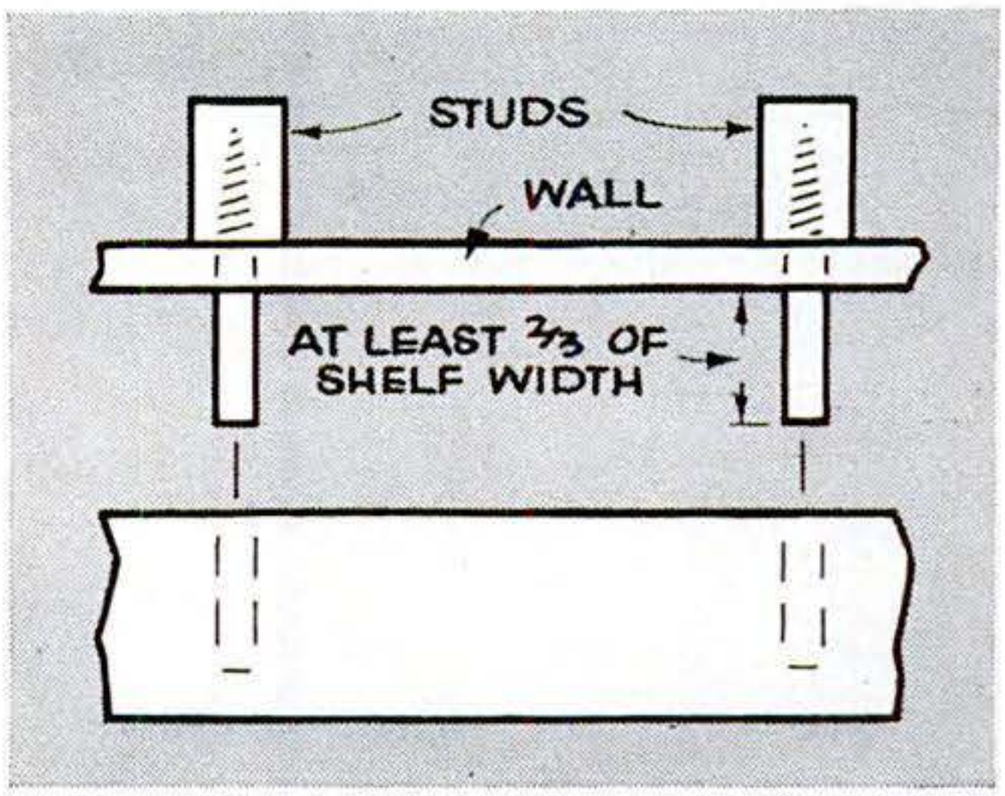
FROM HERE AND THERE



Prevent break-in burglaries

Unless the door jamb is rabbeted, or the lockset is equipped with a deadbolt, your home is subject to break-in. Any thin material slipped under the door stop will push the striker into the open position. You can prevent this by driving three or four 4d finishing nails into the stop in front of the striker plate. Set the nails and fill with plastic wood. When the filler is dry, sand and paint.

H. WICKS, Floral Park, N.Y.



Shelf with no visible support

Hang a shelf with no visible support by using ¼" lag screws. The shelf can be as long as you want, but it must be at least 18" long, to span two studs. Hold the board in place, check with a level, and draw a light line along the wall, marking the shelf top. Drill a pilot hole in the studs for each lag screw, ⅜" below the line. Line up the shelving with the holes and drill matching ¼" holes. Insert the lag screws in the wall and cut the heads off. Smooth any burrs with a file and slide the shelf onto the lag screws.

H. VERNON, Brooklyn, N.Y.

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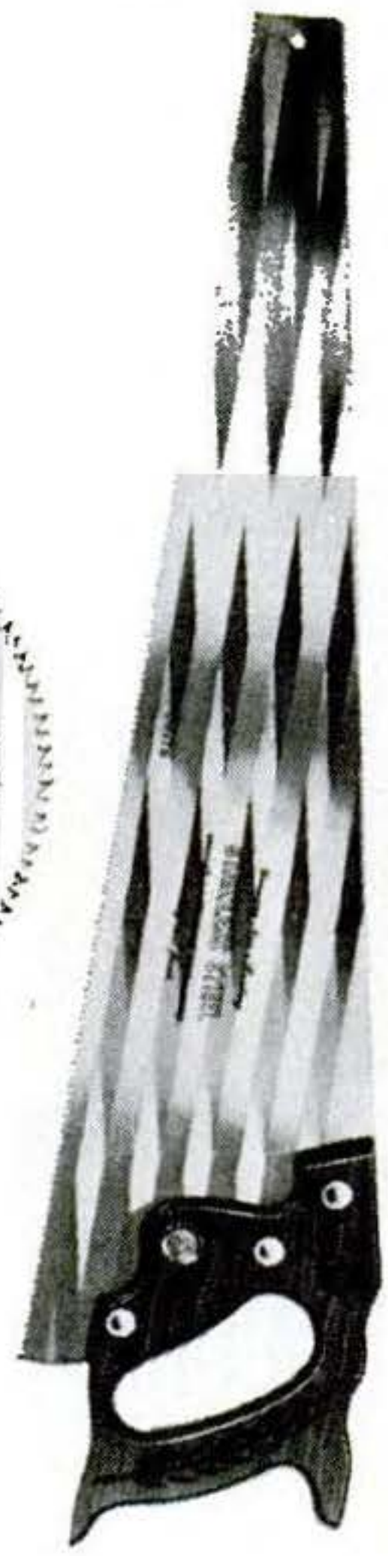
Any way you slice it, it seems like baloney



Whether you're woodcutting by hand or with power, it's like slicing through baloney when you use a Nicholson saw blade.

Nicholson's Stainless Steel handsaws are taper-ground to glide through lumber. And Nicholson's Magicut power saw blades have individually set and sharpened teeth with real bite in them.

Get either . . . and you'll *cut it like you never cut it before!* That's no baloney.

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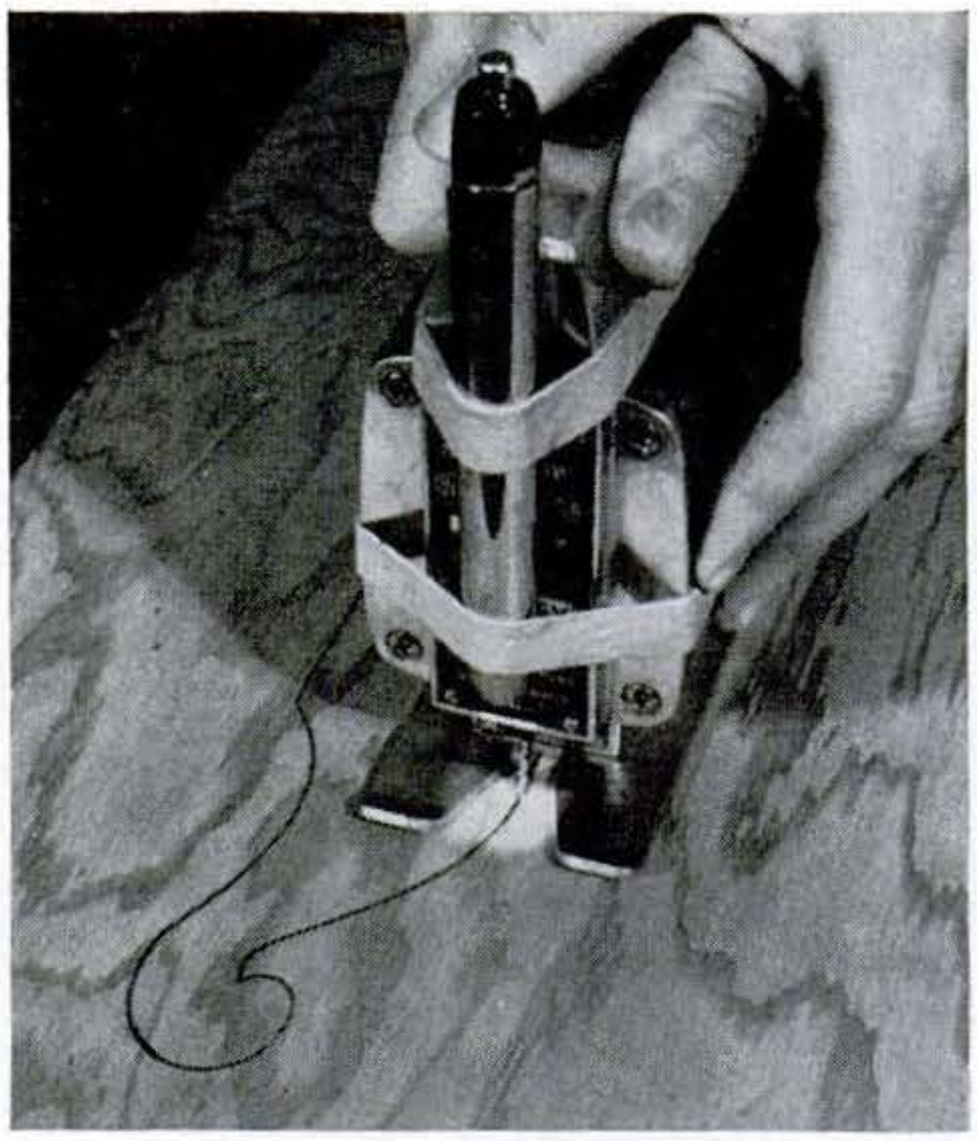
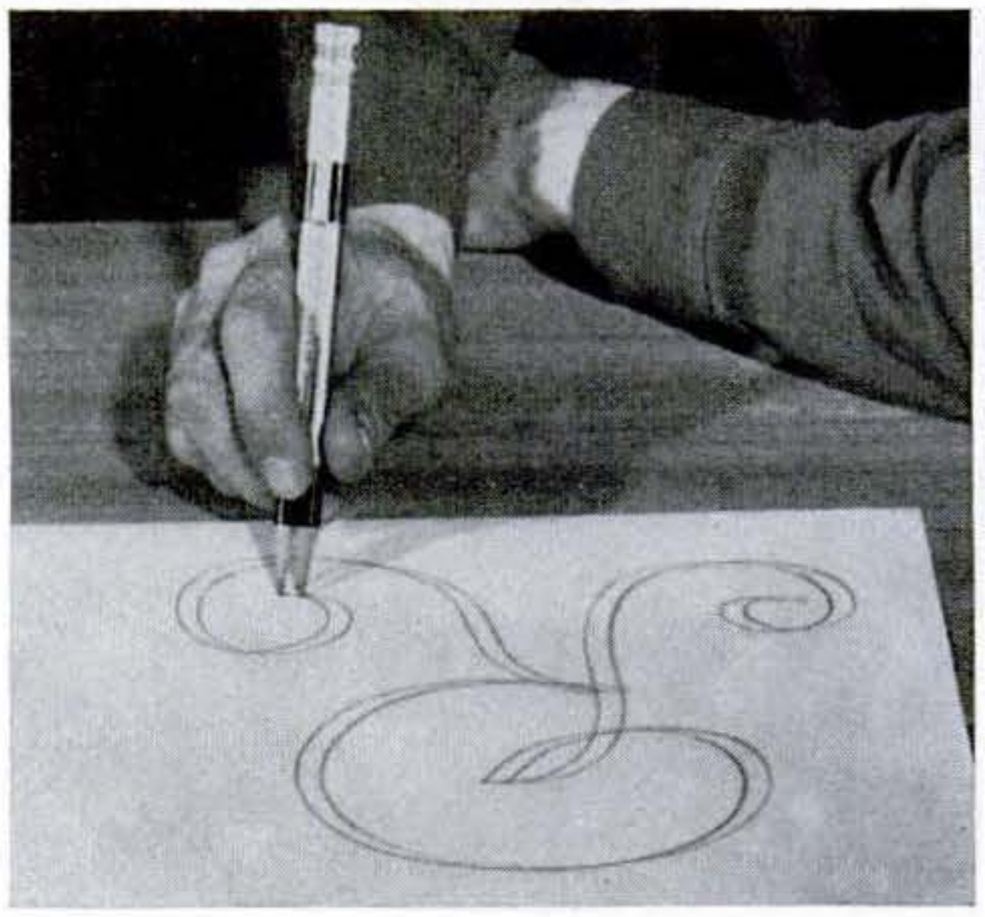


How to saw where you're seeing

For maximum accuracy with your saber saw, attach a penlight to the housing with two strong rubber bands. Adjust the light to fall directly on the cutting area. Place the bands so they don't interfere with the proper ventilation of the saw.

W. B. SILL, NYC.



When two are better than one

Try using pens or pencils in tandem for fancy lettering effects. Tape them together and keep both points in contact with the paper as you work. Fill in the double lines with ink or crayons.

R. CAPOTOSTO, Greenlawn, N.Y.

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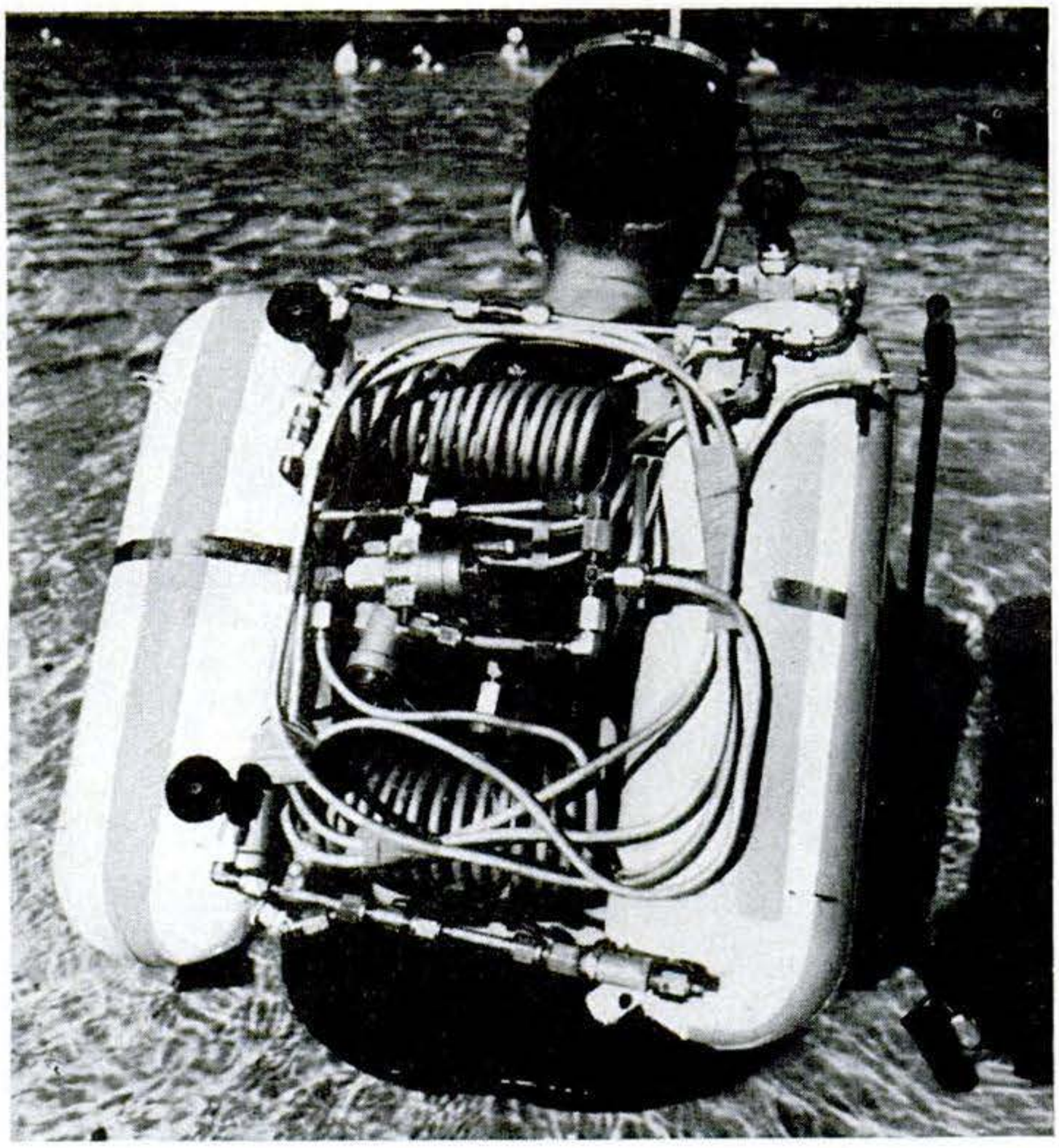
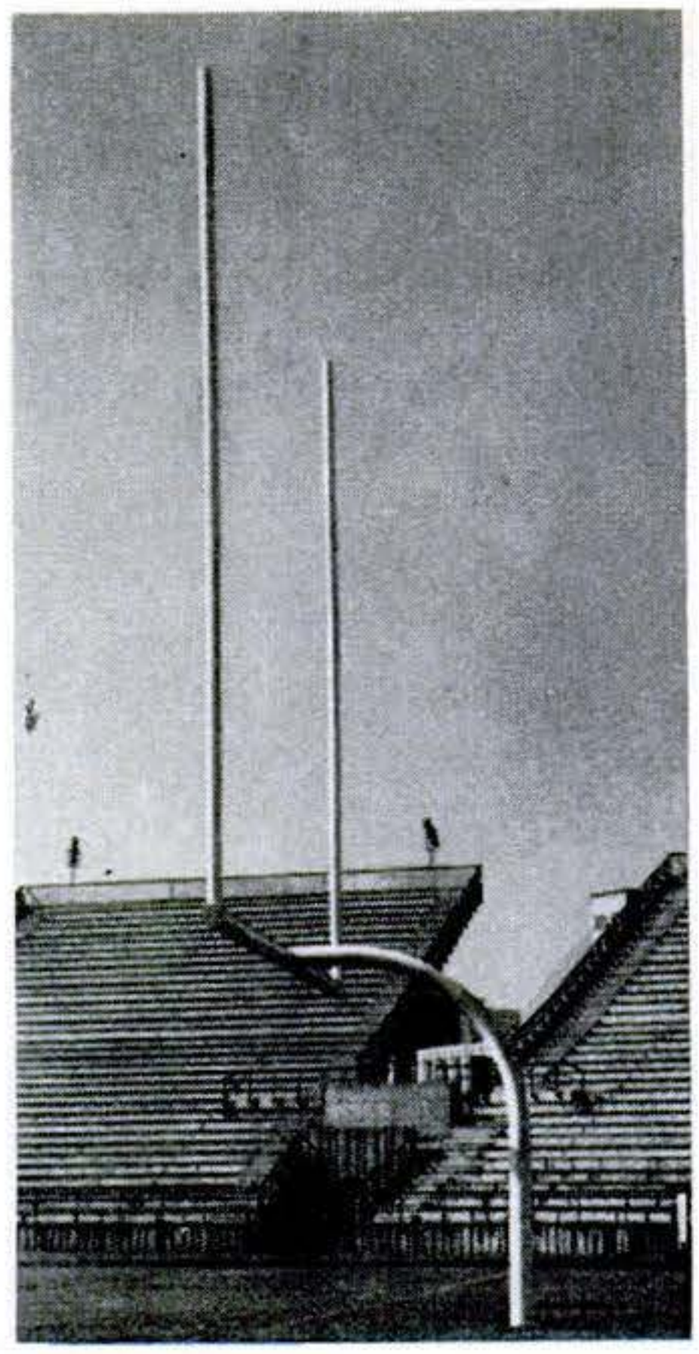


Brrr! Now you can dive with liquid air

Man named Jim Woodberry, a Florida scuba diver, got to thinking that he could spend a lot more time underwater if he carried liquefied air instead of standard compressed air. The result: dives of six to eight hours instead of an hour or two. The stuff's cold, though—318 degrees below zero—and, of course, there's all that plumbing.



Gooseneck goal is safer

Professional football players won't be banging into goal posts any more in their bruising races for points. This goal-post support is now official. The gooseneck is offset six feet behind the goal line. It's used six feet behind the end line for college and high-school games.

But what would you do when it rains?

If an outfit called Vodon Industries, of New York, has its way, motorists will be combing their cars instead of washing them. This kooky "yak" car cover is a shaggy synthetic fabric. Prices start at $300. The thing you see just ahead of the driver's door is actually a comb. It's a handy accessory that sells for a mere $2.

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21 exciting new motors -- 1½ to 115 horsepower ...and featuring a sensational new mid-range motor that combines the size and economy of a compact "50" with the speed and performance of a hot "65"...

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new EVINRUDE TRIUMPH 55 hp

It does everything our competitors were afraid it would

It puts fast runabouts and hot ski boats in the over-40 mph class. Pops gangs of skiers out of deep water, and pulls single skiers at tournament speeds. And does big-motor duty at the fuel cost of the smallest motors in the mid-range class.

Everything about the new 3-cylinder Triumph 55 is designed to deliver more speed and more thrust from less bulk and less fuel.

The fueling and combustion system is not just different — it's more efficient than any high performance outboard ever built before.

The lower unit shape is straight out of a computer.

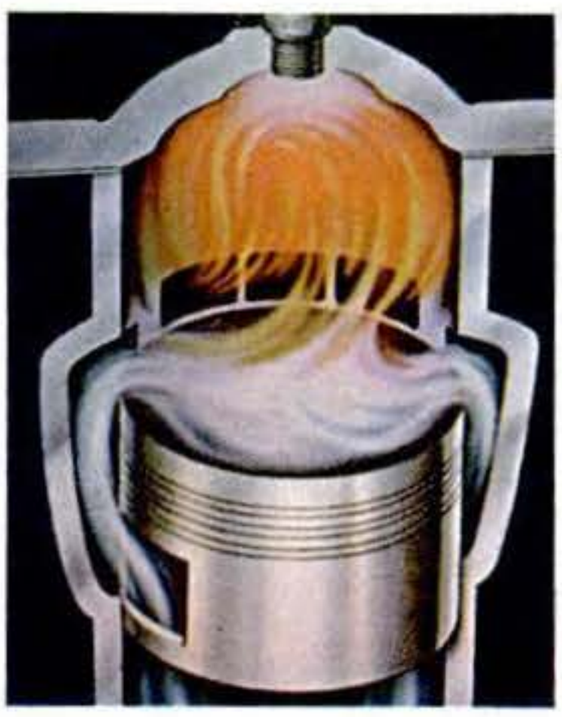
The tuned exhaust is jetted through the propeller hub in a space age refinement of a system first developed by Ole Evinrude for the high performance engines of two generations ago.

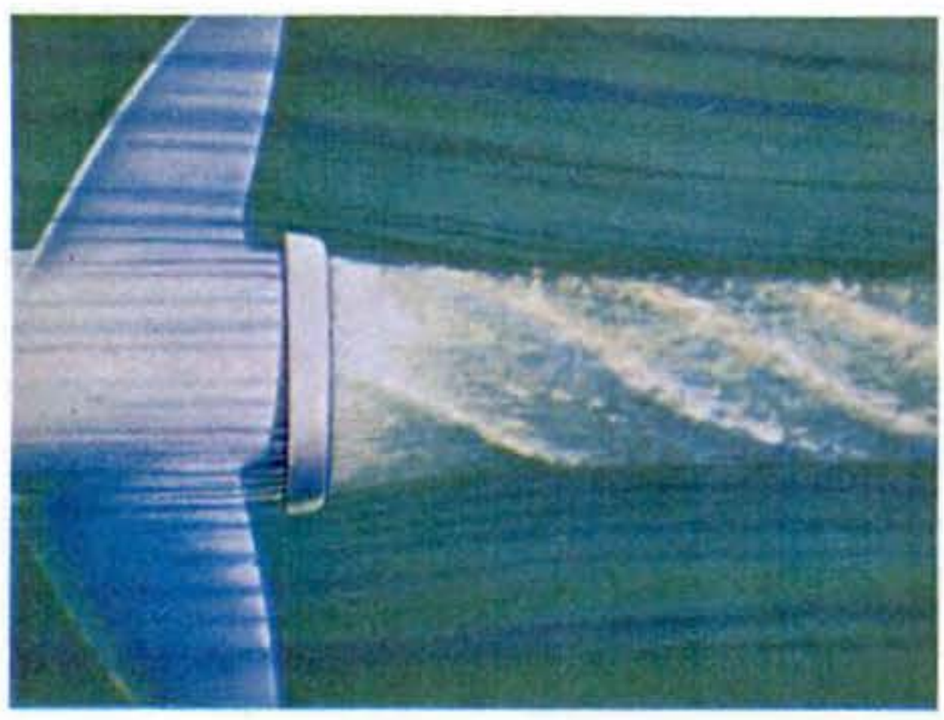
The power is put to work by a selection of high rake, progressive pitch propellers that combine high thrust with high speed to a degree never achieved before.

And the Triumph's performance is matched by its luxury.

Push button electro-hydraulic shifting is standard (with controls furnished). So is high intensity CD electronic ignition, full-range sound-sealed quieting, electric starting, automatic choke, 9 amp alternator, thermostat temperature control, and adjustable stern brackets.

We call it the Triumph — one ride and you'll know why.





Left above — Upward-slanted intake ports aim the incoming fuel charge directly into the top of the combustion chamber — eliminating the need for a piston deflector to keep the fuel charge from "short circuiting" across the top of the piston.

Right above — An ingenious Thrust Accelerator Ring (Pat. Pending) squeezes the flow *inward* — in a converging cone that confines exhaust thrust to the vortex directly behind the propeller hub — preventing exhaust gases from reaching the propeller blades and causing cavitation.

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new EVINRUDE MATE 1½hp

Weighs just 19 lbs. —pushes a loaded canoe twice as fast as you can

A lot of people have waited a long time for a motor as small, and light, and powerful as this.

Just 19 lbs. — yet its geared-down, high-thrust propeller will push a load of 1900.

It will cruise as fast as 8 mph., and as far as five miles on a pint of fuel.

But don't let its small size or low price fool you.

It's *all* Evinrude. Made the same way the big Evinrudes are made. With cast iron cylinder liner. And a full set of controls and adjustments (including 360° steering). With anti-friction bearings and balanced crankshaft, intake and exhaust silencing, and quiet gears. Fully salt water engineered.

It's the most motor made — for anywhere near its size or price.

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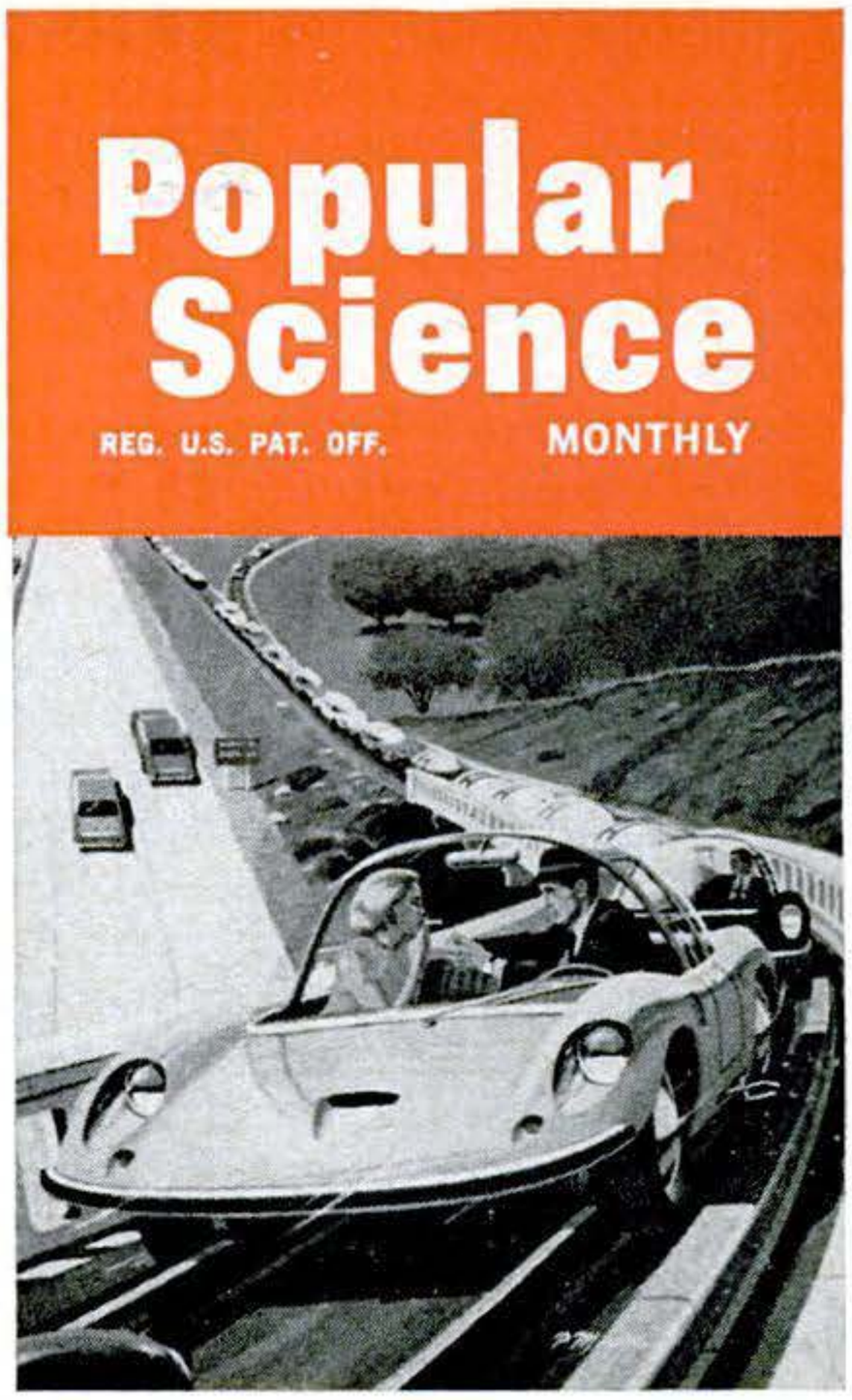
A U.S.-backed $100,000 study at a world-famous lab is working out the design of the commuter's car of tomorrow—and its electric-tracked guideway to the city and back

How You'll "Drive" the Amazing URBMOBILE



By C. P. GILMORE

You gulp the last of your coffee, wipe the egg off your chin, and dash for the door. In the driveway sits a vehicle about the size and shape of a Volkswagen. Beside the door on the driver's side is a handleless hatch. Beneath the car, unseen, are four flanged wheels of smaller diameter than the car's tires. One is attached to the inside rim of each big wheel.

As you slide away from the curb, the sound of the electric drive motor hardly rises above a whisper. A few blocks from home, you steer the car into a special lane, and pull a lever under the dash. The front wheels lock in straight-ahead position. Simultaneously the side-hatch door slides back and an electric third-rail shoe folds out. It makes contact with a power rail, the flanged wheels roll onto rails of a track, and your car accelerates at a controlled rate of 0.3 g. You twirl a dial until you see "5th Street" appear in a small window. Seconds later, as your car enters a main guideway at exactly 60 m.p.h., you open the paper and begin scanning the news.

The system that you're riding: Urbmobile. The year: 1985, or perhaps sooner. Right now, a crack team of engineers and transportation experts at the world-famous Cornell Aeronautical Laboratory (CAL) is working on such a system's basic design. If things go well, it could come in the Seventies.

Urbmobile is intended to do something about one of the country's fastest-growing problems: getting people to the city and back. Today, new freeways are jammed as soon as they're built. Downtown areas are choked with cars. Parking is impossible.

Teams of planners across the country are seeking ways out of the worsening crush. Suggestions to date include:

- Minicars that would be driven to downtown areas, then collected and towed away in strings by tractors.
- Pallet systems to whisk cars downtown on special railway flatcars.
- Urbmobile, being studied by CAL under a $100,000 Department of Housing and Urban Development contract.

Which system or combination might prove practical, no one knows now, but the problem's basic factors are clear:

Cars offer the most convenient door-

Continued

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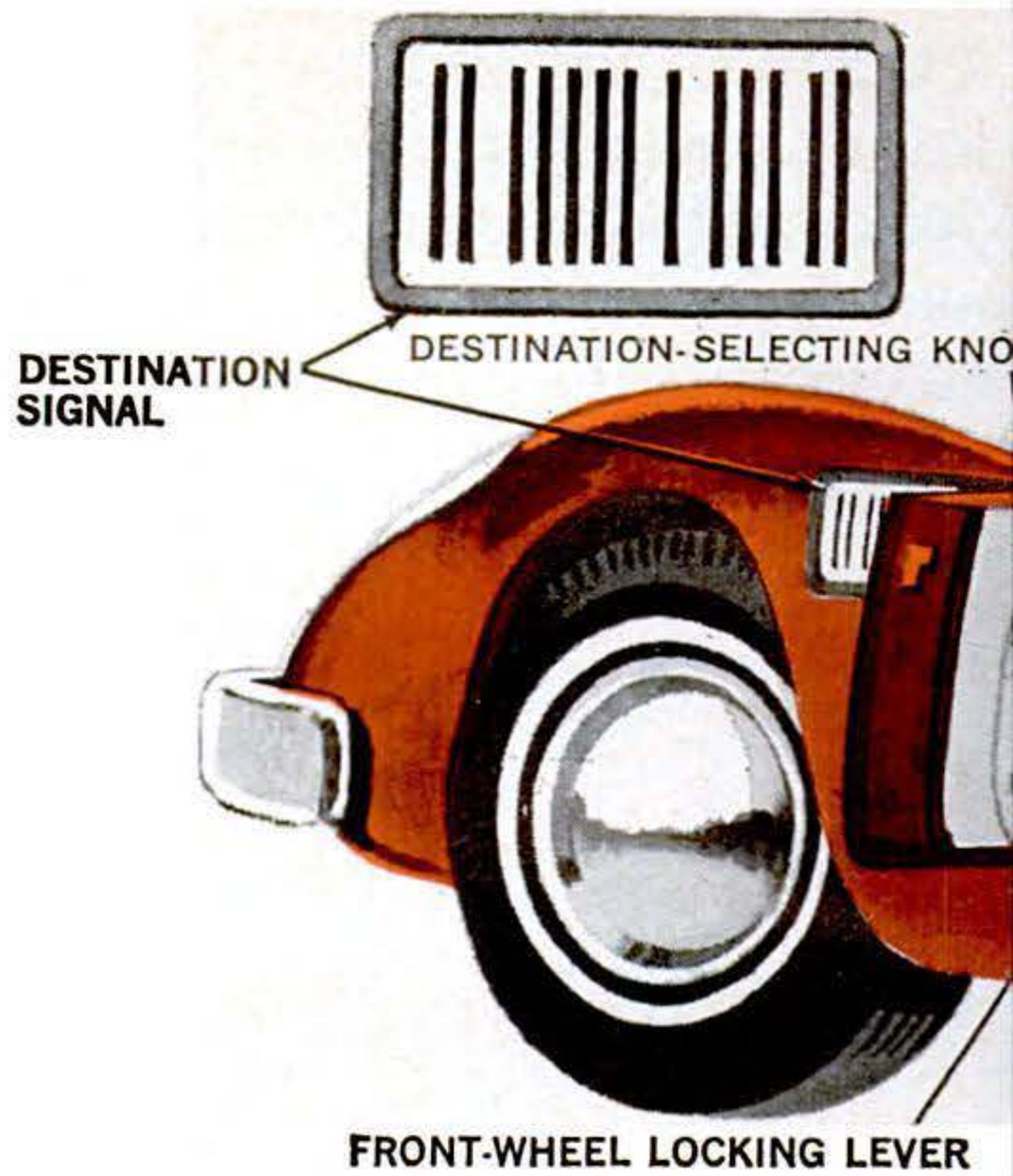
to-door transportation, so people want to drive to work. But cars are inefficient people carriers. One 12-foot expressway lane carries less than 3,000 people an hour. And parked cars take up huge amounts of expensive real estate.

Rapid-transit systems such as subways and trains are far more efficient. A single track carries up to 40,000 people an hour. But rapid transit doesn't haul people door-to-door.

Urbmobile is designed to combine most of both systems' advantages, and few of either's drawbacks. "What we wanted to invent," says Robert A. Wolf, head of the transportation research department at CAL, "was a door-to-door system with high capacity—something like rapid transit combined with the convenience of the automobile."



You feel the car decelerate and look up from your paper. You're gliding into the 5th Street Station. You fold your paper as the Urbmobile comes to a gentle, automatic stop. A gate in a low wall swings open on each side of the guideway. You step out and head for your office a few blocks away. As you leave, your driverless Urbmobile pulls out, and heads back for the main track. Fifteen minutes later it slides into a parking stall 12 miles from the downtown congestion.

The Urbmobile concept may sound futuristic. But its development would require no breakthroughs, not a single discovery. "All the equipment needed," says project engineer Morton I. Weinberg, who heads the CAL Urbmobile task force, "is essentially state-of-the-art. That doesn't mean it's off the shelf, but we know how to build it."

A car could be driven, for example, by a three-phase induction motor locked to the frequency of the electric power supply. All cars would be tied to this system, so all would automatically run at the same speed—60 m.p.h. Such a system would be accurate to within two or three percent. One car might slowly overtake another; they'd nudge gently, though, with bumpers designed to cushion the contact. It wouldn't hurt anything for two to run along touching.

Off the guideway, DC current from the car's battery would be changed to AC by silicon-controlled rectifiers. A frequency-control system would vary the frequency of the power as you pushed or released the accelerator, giving speed control. (The GM electric car demonstrated last year used a similar system.) When your Urbmobile entered the guideway, its contactor would touch a special segment of third rail with a built-in frequency-control system, which would accelerate the car smoothly to 60 m.p.h. before feeding it into the mainstream of traffic.

On the street, Urbmobile's top speed would be 40 m.p.h.; its range, 40-80 miles. That's adequate for commuting, trips to the supermarket, and other uses around town. And there's no reason Urbmobile guideways couldn't eventually run from one city to another.

Either on the guideway or on the street, the Urbmobile would cost about half as much to run as present cars. And it would leave no trail of air pollution behind it.

While differing from present cars in many ways, an Urbmobile will resemble them in others. Urbmobiles will probably be built by today's auto makers, on the same production lines, and will offer

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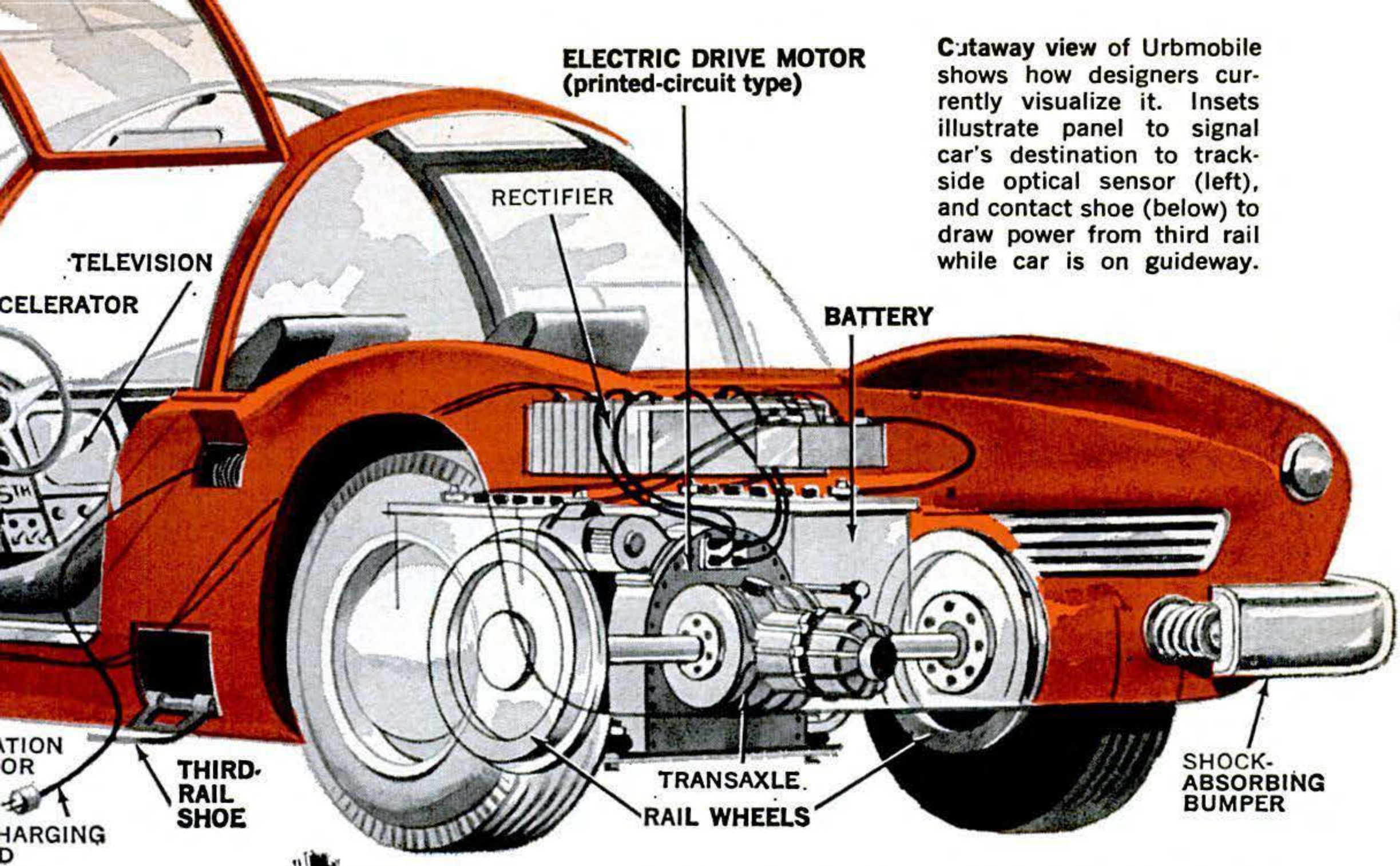
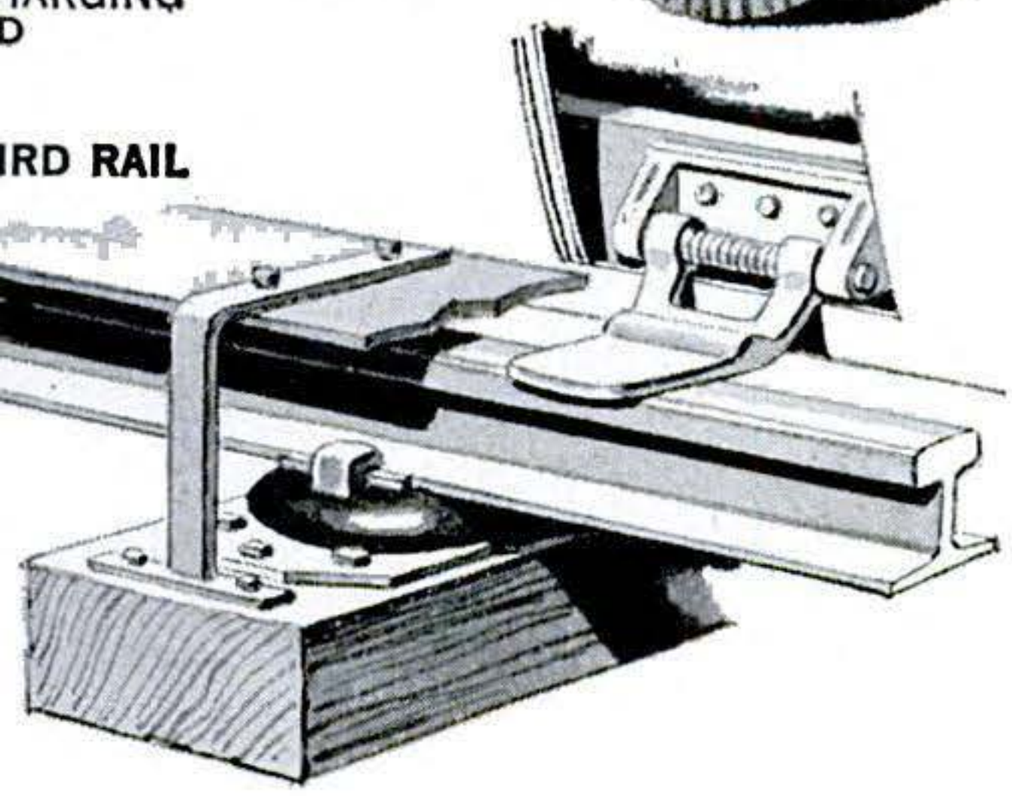


Cutaway view of Urbmobile shows how designers currently visualize it. Insets illustrate panel to signal car's destination to trackside optical sensor (left), and contact shoe (below) to draw power from third rail while car is on guideway.



much of the variety that today's cars do. "They'll all have to fit the track and the third rail," says Weinberg, "but they could have different colors, body styles, and accessories."

CAL's planners emphasize that their study is in an early stage. Features that look good now may change.

Cars running on steel wheels offer the best promise, they've tentatively decided. A steel wheel doesn't get flats. Flanged wheels on steel rails don't skid. And there's no guidance problem that hasn't been solved years ago by railroads. "When an automobile is on the guideway," Weinberg says, "it's just a little conventional trolley car."

But there are other possibilities. Urbmobile might be built, say, like the Montreal subway: One set of rubber tires on a flat surface supports the vehicle. Another set, at right angles, sticks out on each side to keep the car centered in a trough.

Urbmobile's designers first planned to use two 20-hp. electric drive motors, one near each rear wheel. But the most logical suspension would then be a swing axle, hinged in the middle—and as the car moved up and down, the rear wheels' distance apart would vary enough to allow them to jump the track. Easiest solution was to put them on a common axle and go back to a conventional differential, and probably a single drive motor. The Cornell group thinks standard front-wheel suspension, which tends to keep the front wheels' contact points almost constant, can probably be used just about as is.

Anticipating trouble. To assure a safe system, Weinberg and his group spend a lot of time thinking of all the things that could possibly go wrong, and what would happen if they did.

What if a car's third-rail shoe breaks or its motor burns out, and it loses power? "There may be other cars coming up behind you," he says, "and their drivers may be napping or reading the paper.

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You can't have them plowing into a stalled car." The best solution, as the CAL group now sees it, is ingenious and simple:

Every few feet along the track are magnetometers—magnetic devices that sense passing cars. If a car begins to slow down, the magnetometers detect the longer-than-normal time to pass successive sensors. Instantly, control circuits kill all power to the section of track occupied by the disabled car.

"All cars will be built to brake automatically, at the same rate, if they lose power," says Weinberg. So the cars' spacing should stay the same as they roll to a stop. A service vehicle running along the side of the track will lift off the disabled car, and then the system will resume operating.

While the power to one section of track was shut off, the system would shunt all approaching cars off the guideway. Drivers would be annoyed by the inconvenience, but they wouldn't be dead. They could either complete their trip by road, or drive to the first station beyond the "dead" section of track and reenter the guideway there.

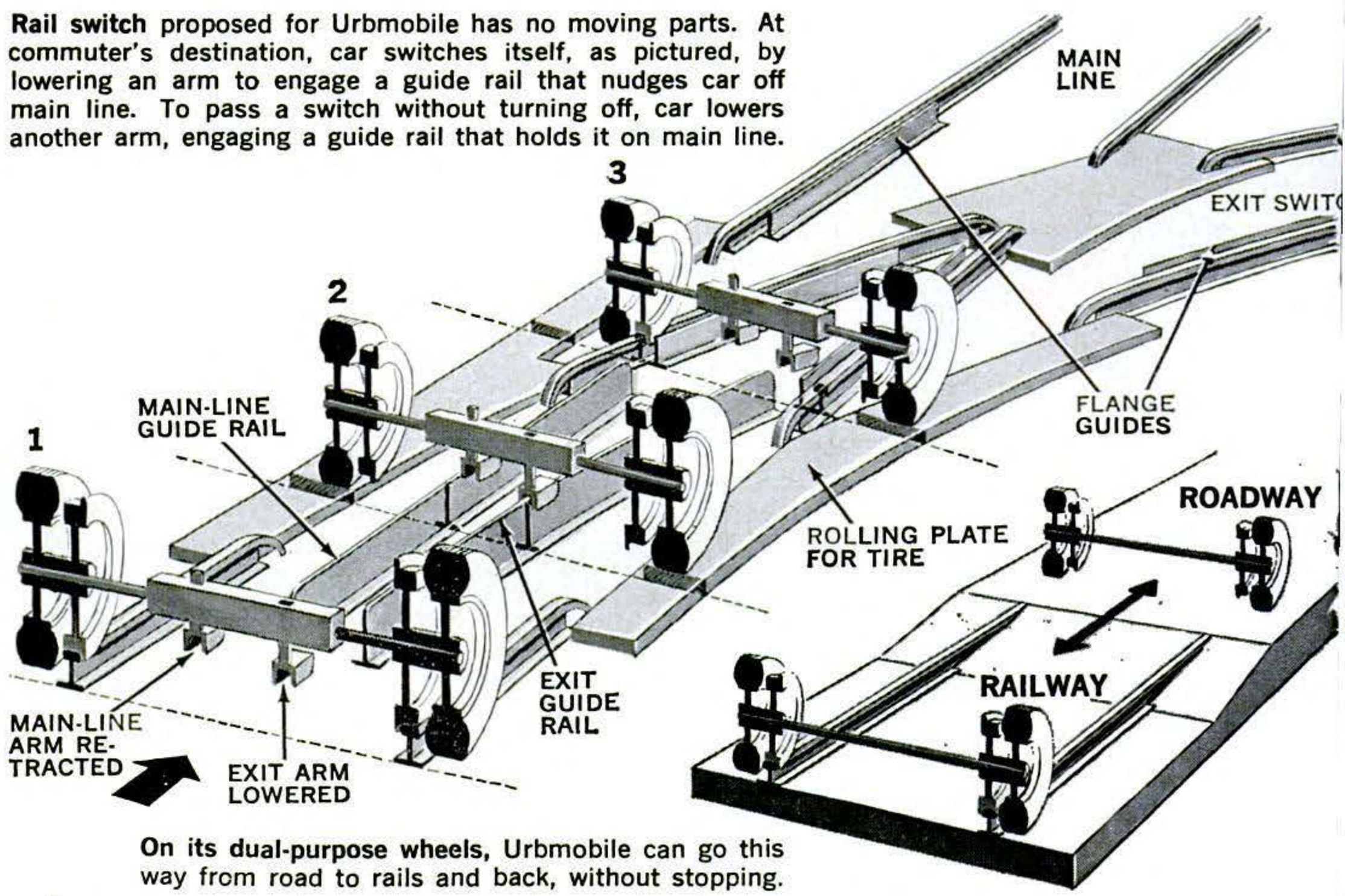
It's 4:40. You pick up the phone and dial a special code. Twelve miles away, the motor in your car begins to hum. Just as you reach the station, your car pulls into a temporary holding area. You climb in, twirl the destination dial to "Elm Street, Northville." As the car accelerates, you flip on the TV to catch the news on the way home.

The Urbmobile system will require only a relatively small right-of-way. Cornell planners anticipate a maximum of 25 feet, about the same as two 12-foot traffic lanes. Into the 25-foot strip will go two Urbmobile guideways—one into town, one outbound—and a center service strip for emergency vehicles. In some cases, the service strip might not even be necessary.

"Suppose you have a very wide street, such as Woodward Avenue in Detroit," Weinberg says. "You could run a pair of Urbmobile guideways right down the middle of the street—in a slot only 16 feet wide, and just deep enough for Urbmobiles to pass under cross streets. You wouldn't need a service lane; emergency vehicles could use the street. You'd lose two lanes of traffic, but it would be worth it. Once you put those guideway lanes down there, the street would be

[Continued on page 208]

Rail switch proposed for Urbmobile has no moving parts. At commuter's destination, car switches itself, as pictured, by lowering an arm to engage a guide rail that nudges car off main line. To pass a switch without turning off, car lowers another arm, engaging a guide rail that holds it on main line.



On its dual-purpose wheels, Urbmobile can go this way from road to rails and back, without stopping.

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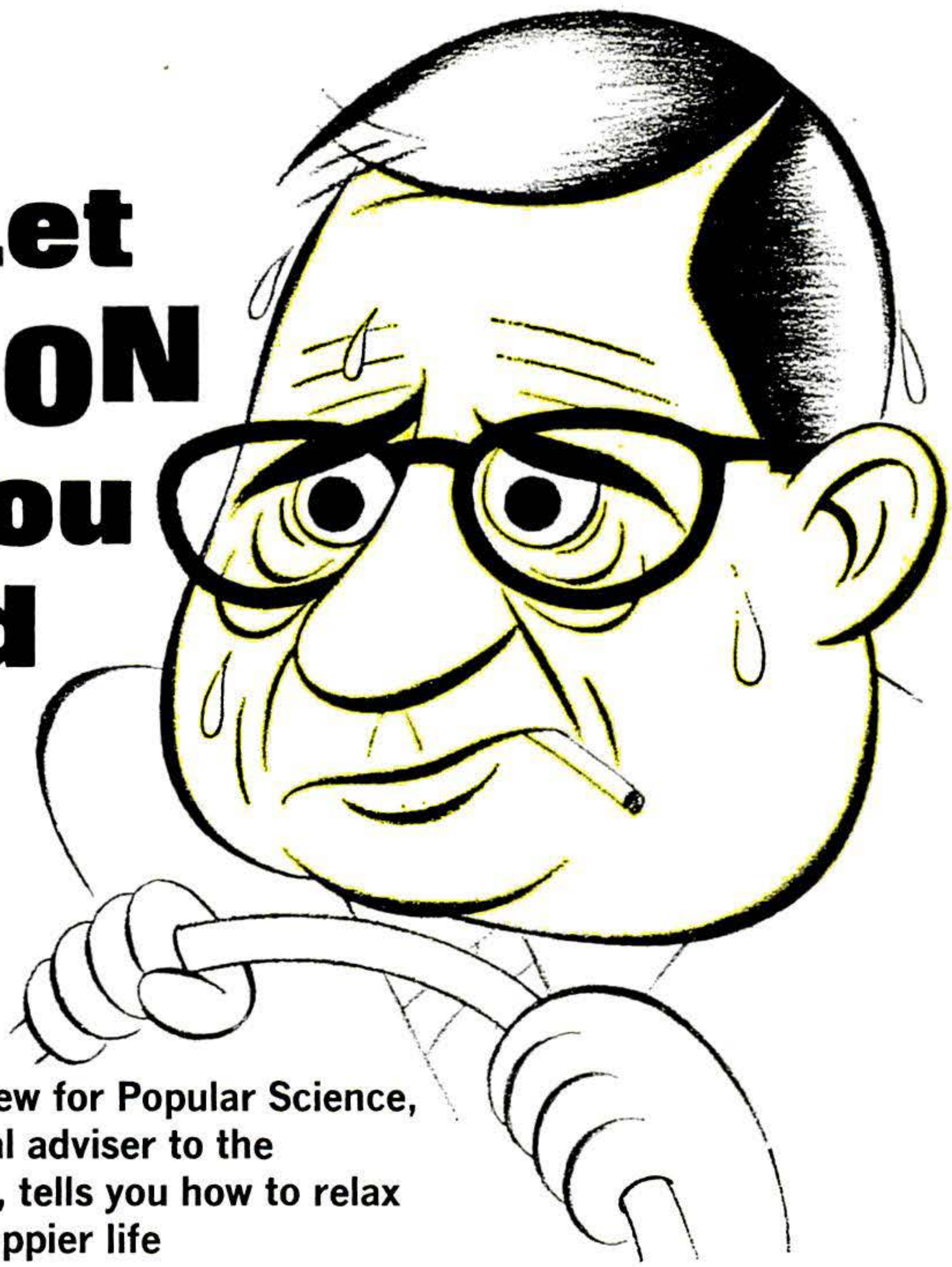
Don't Let TENSION Push You Around



By CURTIS MITCHELL

In this exclusive interview for Popular Science, Dr. Hans Kraus, medical adviser to the late President Kennedy, tells you how to relax and lead a healthier, happier life

This is the tension generation. You are surrounded by an unforgiving environment that abrades and snips and slices relentlessly at your exposed psyche.

Is this any way to run your life? No. Is there a better way? You bet there is. And the man who says so is Dr. Hans Kraus, associate professor of Physical Medicine and Rehabilitation at New York University, in his best-selling book, *Backache, Stress, and Tension* (Simon & Schuster).

The whole western world is suffering from hypokinetic disease, which is produced by lack of exercise, he says. "Today we are mechanized, urbanized, and unbalanced. We are overfed and overstimulated. At the same time, we are under-exercised unless we go out and get it—which means that we are *under-released* because civilization has forced us to suppress our impulses."

Many authorities back him up. Famed heart specialist Dr. Paul Dudley White says, "To get physically tired is the best antidote for nervous tension. It is one of the things that we insisted former President Eisenhower must do after his heart attack."

A variety of stresses afflict us, Dr. Kraus says. There are external irritants such as crowds and deadlines, internal irritants that result from personal problems. Your emotions affect your muscles. The two are bound up together.

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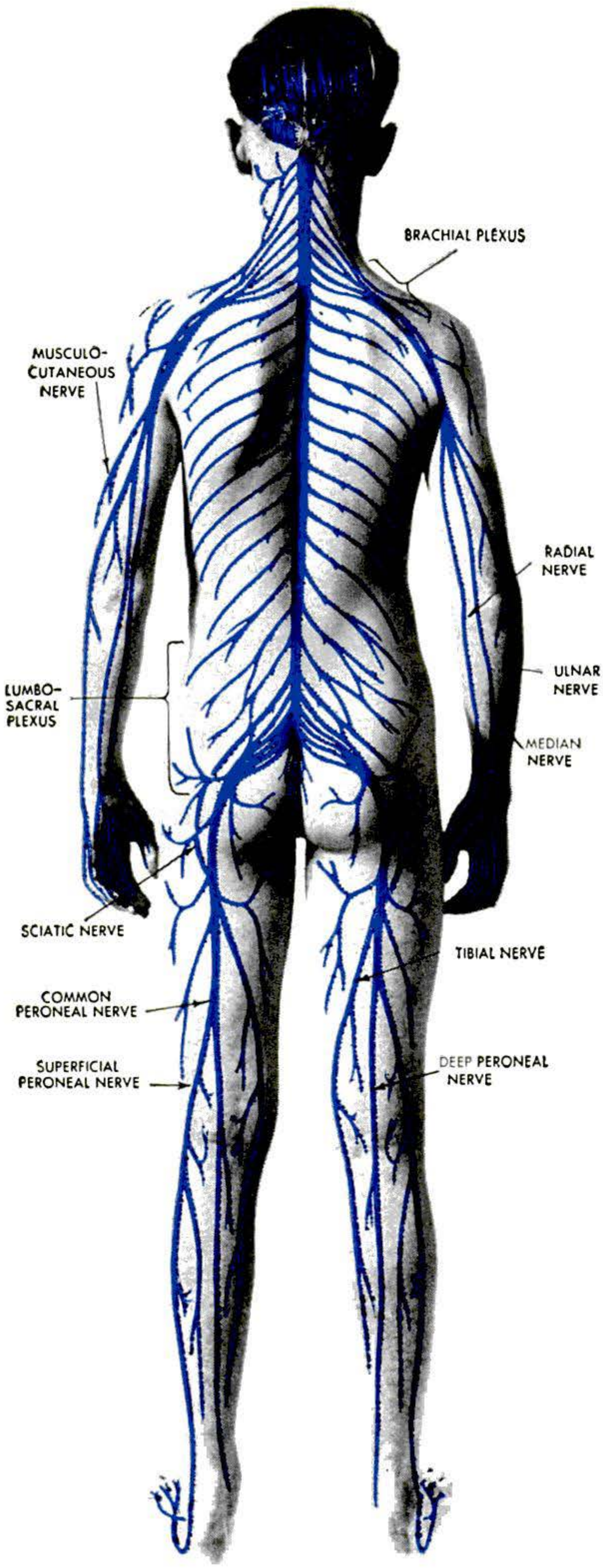

What you call nerves are bundles of fibers that carry impulses from receptors in your body. The impulse is relayed to your brain via nerve cells in the spinal column. These impulses, traveling along your nervous system (above), control your muscles.

How do you escape? "Rest is still needed," Dr. Kraus says, "but it should be rest from stimuli, not from activity."

The fight-or-flight response. Scientists have searched for the source of tension for many years. In 1915, Prof. Walter Cannon of Harvard University called it man's flight-or-fight syndrome. Cannon discovered that the body was, in part, an unparalleled automatic machine, working often without benefit of will power.

One of his experiments exposed a cat to the barking of a dog. Instantaneously, the cat's back arched. Hairs stood on end. Its pupils enlarged. Its blood pressure rose. Heart and lungs pumped faster. Digestive action in the stomach ceased. Body temperature rose and muscles tensed. Adrenal glands poured adrenalin into the bloodstream. It spat and hissed. Cannon's cat did all those things in a wink, without thought. When he shifted his experiments to humans, he got similar results.

Then he learned something else. *If the stimulus that caused the alarm reaction persisted for too long, both animal and human physiques broke down.* Nobody knew why.

Dr. Cannon reasoned that evolution had so perfected our species that we had come to possess a system of internal controls designed to meet emergency hazards. When his life was endangered, a cave man could either fight or run away. In either case, the legs would need much extra blood to nourish their muscles, the internal organs would require almost none. That could be the reason that heart and lungs increased their pumping action, whereas the stomach and kidneys

Ground Rules for Relaxing

1) Check with your physician to make sure you have no ailment that can be made worse by exercise.

2) Get into a relaxed state. Sit down and relax—mentally and physically—for five or 10 minutes. As you "feel" tension anywhere in your body, let it go, until limp like a rag doll.

3) Begin to exercise slowly and smoothly without jerking any muscle. Start with 10 minutes—but gradually work up to a half-hour. Never strain.

4) Establish a daily schedule and keep it. Any time is a good time—except after a meal.

Exercises to Help You Stay Relaxed

1) Wobble your head, shoulders, arms, thighs, feet, and legs. Raise your arms slowly overhead

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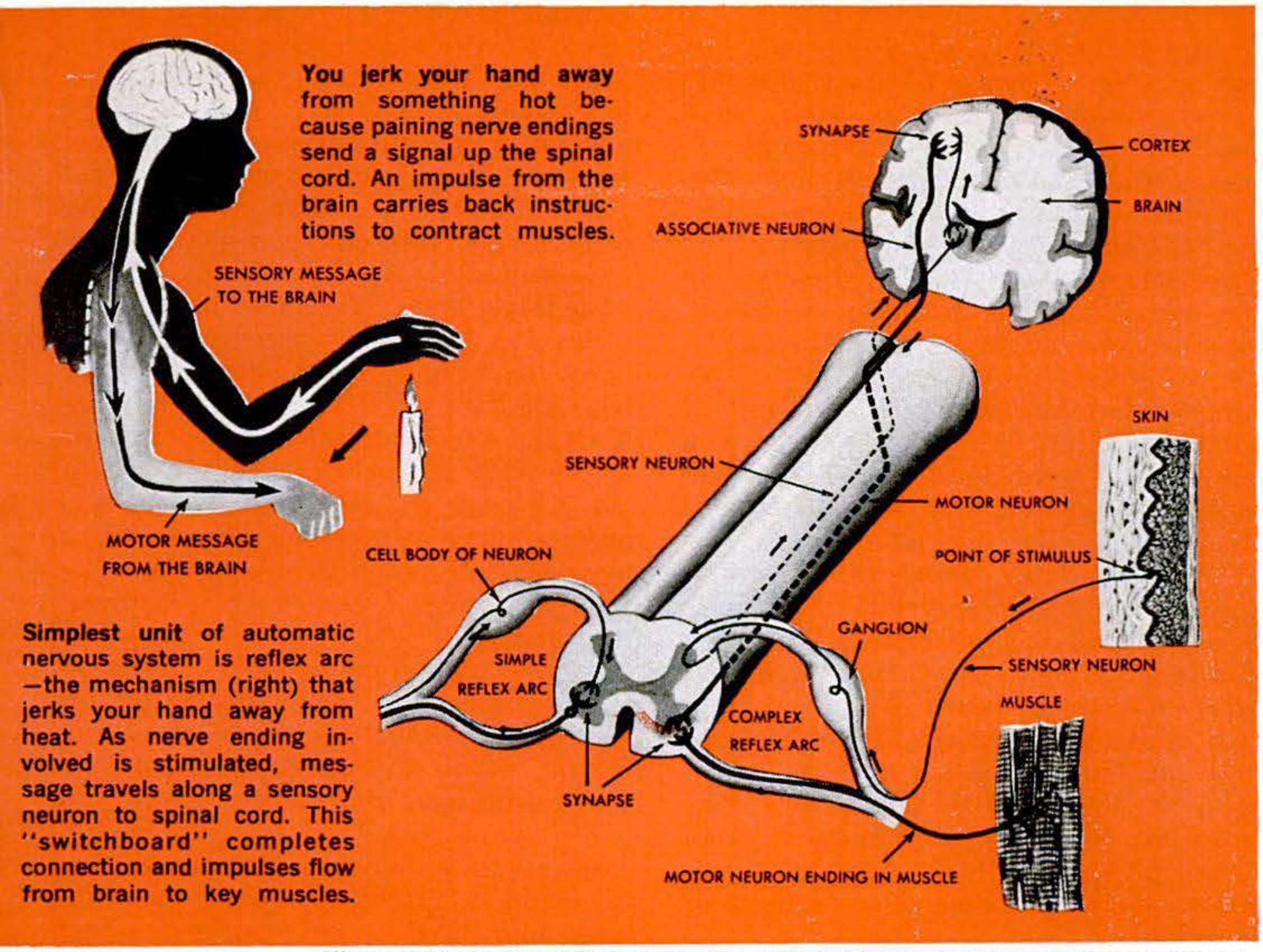

Simplest unit of automatic nervous system is reflex arc —the mechanism (right) that jerks your hand away from heat. As nerve ending involved is stimulated, message travels along a sensory neuron to spinal cord. This "switchboard" completes connection and impulses flow from brain to key muscles.

Illustrations courtesy of Today's Health, *published by the American Medical Association*

went on a holiday. Today, our organs react the same way.

But we no longer need this automatic protection. In fact, it is killing us.

"Our trouble begins because we do not respond to nature's plan," says Dr. Kraus. Instead, when we are irritated or startled, we store up all that natural energy and it remains undischarged. In our cities, we live like caged animals. We are always on the go, constantly stimulated, not by exercise but by our surroundings.

Tensions are stored up in our muscles. This tension shortens muscles and deprives them of elasticity. Once this muscle tightness has reached a sufficiently high level, and the lack of physical activity has weakened our muscles, the stage is set for trouble.

How nerves control mucles. Muscles do not move of themselves. They must be triggered by tiny electric currents flowing

Continued

and suddenly let them drop. Do the same with the legs. After each movement pause five to 10 seconds to feel the full relaxed effect. Finally, breathe deeply, not straining, and exhale slowly.

2) Lie on your back on the floor. Try to feel heavy, as if sinking into the floor. Close your eyes, take a deep breath, and exhale as slowly as you can. Tighten muscles all over your body, hardening them, and let go. Tightening establishes tension and letting go rids you of tension. Breathe deeply and exhale slowly.

3) Lying on the floor, shrug up your shoulders—to your ears—and let them fall back. Breathe deeply and exhale. Turn your head all the way to the left, bring it back to front and center, and relax. Turn to the right and back. Relax.

4) Lying on your back, raise both knees until your feet rest on the floor about 14 inches or so forward of your buttocks. Slowly draw the right knee toward the chest as close as possible. Slowly straighten the leg. When it is fully extended, let it fall limply to the floor. Repeat this six times, first with the right, then the left leg.

5) Roll onto your left side, placing a pillow under your head so it is comfortable. Flex both knees and hips slightly. Now slide the right knee up as close to your chin as possible. Next, slowly extend the leg until it is completely straight. Let it drop limply to the floor. Repeat two or three times with each leg relaxing between efforts.

6) Lie on your stomach. Rest your head on folded arms or hands. Tighten your buttock muscles until they are very firm. Hold for two seconds and let go. Relax. Repeat six times.

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constantly along pathways that make up your nervous system. Without thought, the sensing mechanisms of your eyes, ears, nose, mouth, and skin feed billions of nervous impulses endlessly into the storehouse of your spinal cord and brain. The heat and pain in your finger, for instance, when it touches a hot stove, cause your nerve endings to flash an alarm along an inbound nerve fiber (these are one-way streets) to your spinal cord. The impulse spreads instantly through a switchboard that completes the correct connections. Immediately, impulses flow out to key muscles, and their fibers contract, jerking your fingers to safety.

During your day, nerves often become raceways for pell-mell electrical currents all converging on your spine. When the stimulation is light, the pulses are spaced and your body disposes of them. When stress is great, they strike faster than machine-gun bullets, tensing muscles, building up the tension. Muscles are made for movement, for tensing and relaxing. Such movement is vital. If the tension is continuous and no response is possible, trouble ensues.

Have you ever heard a telephone ringing in a distant room or another part of the office? Someone should answer it, but no one does. You become tense. You are prepared to act, but you do not. Physiologists have found that continuous tensing shortens a muscle; this is called a contracture. When a contracture is suddenly put to work in an emergency, and it tries to respond to your nerve impulses, its below-par physical properties may cause it to fail because of insufficient elasticity or delayed "give." Sometimes it goes into spasm or rips itself apart. A permanently contracted calf muscle, for instance, that becomes tense as the result of an emergency, will sometimes tear.

The target areas. Nervous tension seems to develop in definite target areas. Dr. Kraus explains, "In tension headache, these are the frontalis muscles in the forehead and the occipital muscles running up the back of the head. With a painful and stiff neck, the target area is the neck muscles and the trapezius muscles, which lie over your shoulder blades, and the rhomboid muscles, which lie underneath the trapezius."

Over a generation ago, Dr. Kraus began the work that led finally to his understanding of the ravages of stress and tension. At first, however, he joined scientists who were probing the mystery of man's aching back. Testing thousands of sufferers, they found that 80 percent had no medical disability. Why, he wondered, did "well" people suffer so much pain?

Slowly, he found the answer. Every sufferer had muscles that were either too weak or so tight that they could not relax. Stretched and strengthened, the pain vanished. He concentrated on muscle groups. Sometimes they were so painful that he had to inject novocaine into the "knots" they had tied.

[Continued on page 214]

Exercises for Rebuilding Minimum Strength

1) Lie on the floor and flex your knees, sliding feet along floor. Curl your head and shoulders up off the floor. Hold for a long moment and then lie back, relaxing. Repeat several times.

2) Position as above, raise head off floor, bring right knee up toward chin until you can kiss it. Few succeed at first; don't strain. Continue a moment, relax, and stretch out. Repeat with left knee.

3) Lie on your back with both knees flexed. Fold hands under head. Pull both knees up to your chest, then extend them downward gradually until your legs are straight and your heels a few inches off the floor. Hold for a moment and relax. Repeat.

4) Lie on your stomach with a large pillow under your waist. Anchor your feet under a bed or sofa. Rest hands at your sides. Raise your chest off the floor until the body makes a straight line with the legs. Don't arch the back—it may cause pain and trouble. Hold and relax. Repeat this several times.

5) Get down on your hands and knees. Arch your back high, dropping your head. Now reverse arc of your back, making like a swayback horse, and raise your head. Repeat several times.

6) Stand with hands clasped behind hips. Holding back and neck straight, gradually bend at the hips, making a forward right angle of torso and legs. Bend until you feel the pull and stretching of the hamstring muscles in the back of your thighs. Easy does it. Repeat carefully.

7) Touch the floor while keeping knees straight. If impossible at first, be sure not to force it. One day you'll make it. Straighten up, take a deep breath, exhale, and repeat.

8) Sit on a chair, hands clasped behind neck. Using rear shoulder and upper back muscles, draw both elbows out and back as far as you can. Keep pulling them back to the limit of your range. Return to starting position and relax. Repeat.

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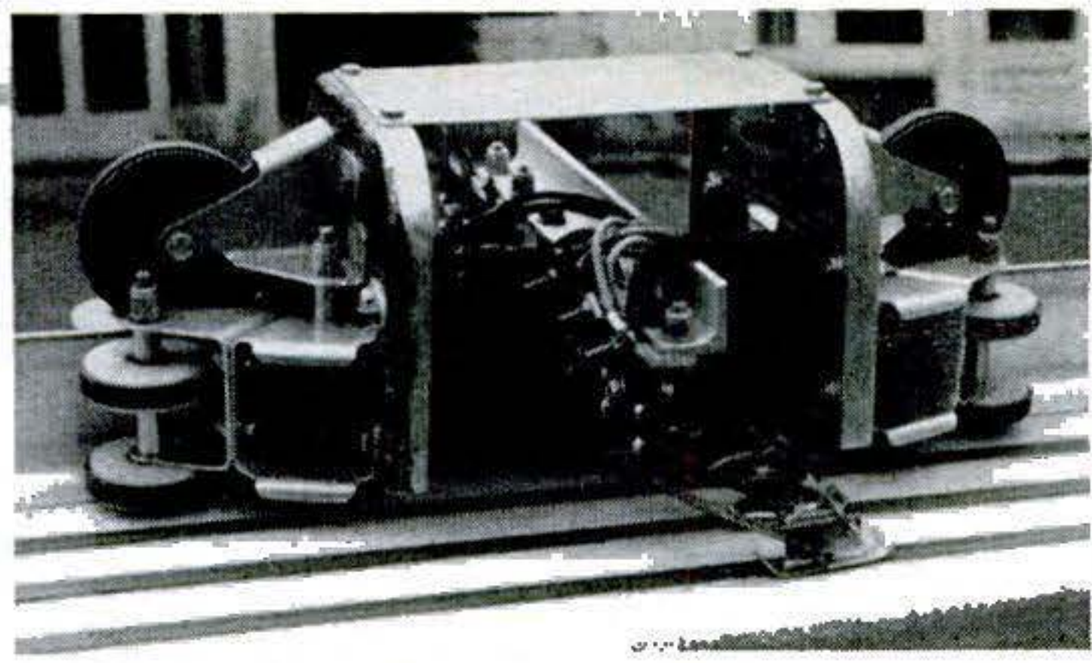
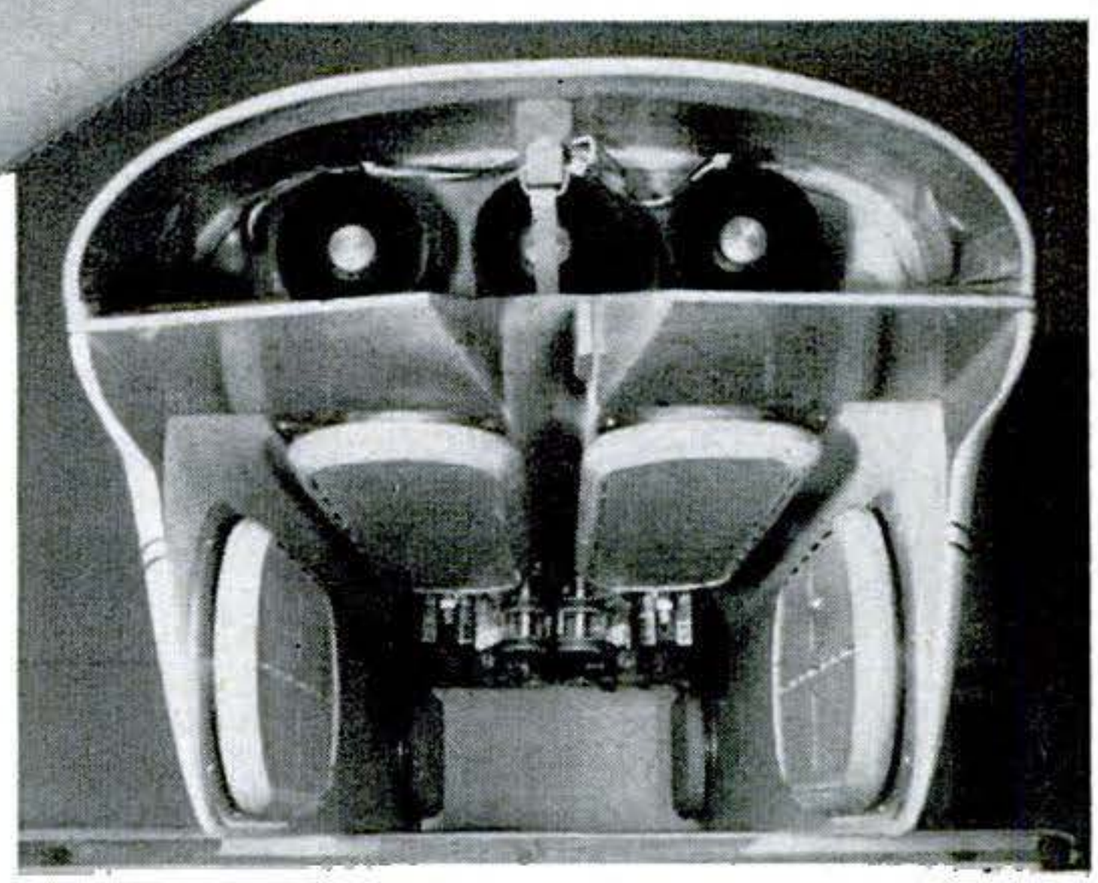
Make way for aircraft speeds on the ground



Half the motor—the coil windings—is in train, other half is in track. Stabilizing wheels are temporary.

Model zips along track at Hythe, England. Full-scale train would ride on air.

The English are actually getting around to testing a model of a 200-mile-an-hour train, first described in POPULAR SCIENCE six years ago [Nov. '61]. It may provide aircraft speeds on the ground. The proposed train has two exciting features—power comes from a linear induction motor, which is a sort of conventional motor laid out flat; and it will ride on an air cushion, without touching its track. This kind of rail transport could be the answer to overburdened highways for commuting.



The future: Fans provide air support through lift pads and, for lateral guidance, side pads.

Jet flies at thrice speed of sound

Latest U.S. Air Force reconnaissance plane is this pencil-like item called the SR-71, designed to fly at three times the speed of sound at altitudes above 80,000 feet—or some 16 miles. The plane is assigned to Strategic Air Command, carries a crew of two. Designed by Lockheed Aircraft, it is powered by two Pratt & Whitney engines.

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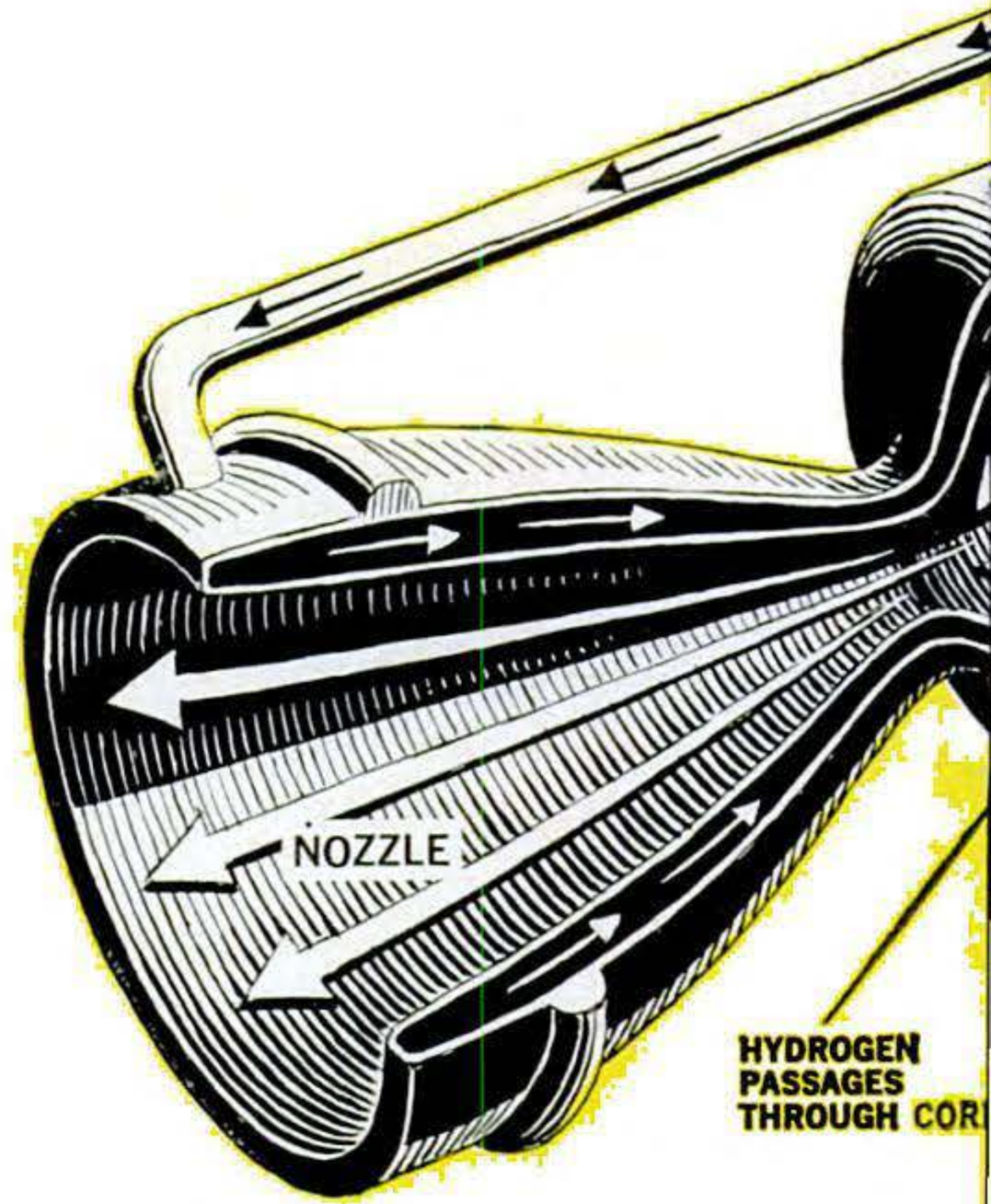
Flying nuclear engine, NERVA, will work this way. Hydrogen from pump, after cooling nozzle, streams through white-hot core of reactor. Blast of heated gas from nozzle propels rocket. Tapped-off hydrogen drives turbopump, and exhausts through small nozzles that can control attitude or augment thrust.

HOW WE'LL TRAVEL BEYOND THE MOON

Nuclear rocket engines of mighty power, needed for our manned voyages of the future to other planets, are being perfected in current firing trials in Nevada

By DR. WERNHER VON BRAUN

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.



Successful tests have lately brought a flyable nuclear rocket engine within predictable range—eight or nine years and upward of $1 billion more, by a current estimate. Should we buy it?

Backed by the President, AEC and NASA recently asked funds to go full steam ahead. In authorization bills, Congress tentatively approved most of the amount sought for the coming year.

Still pending, as this was written, was Congress' final action on the agencies' actual appropriations. There was a question whether economy-enforced cuts might defer the full-scale nuclear-engine effort. But, sooner or later, it looked bound to come. Here, Dr. von Braun tells why.—The Editors.

NERVA, a nuclear rocket engine with a thrust of 200,000 to 250,000 pounds and a reactor power equivalent to about 6,700,000 horsepower, will one day enable astronauts to visit the planet Mars. It will give us enough rocket power to fly a sizable group of explorers to the moon without stopover and rendezvous in lunar orbit. It will support these explorers with a cargo-carrying system that can land much greater loads on the lunar surface, and reduce the cost of transporting them.

The NERVA engine, whose name stands for Nuclear Engine for Rocket Vehicle Application, is the goal of a nuclear-rocket program jointly sponsored and conducted since 1958 by the Atomic

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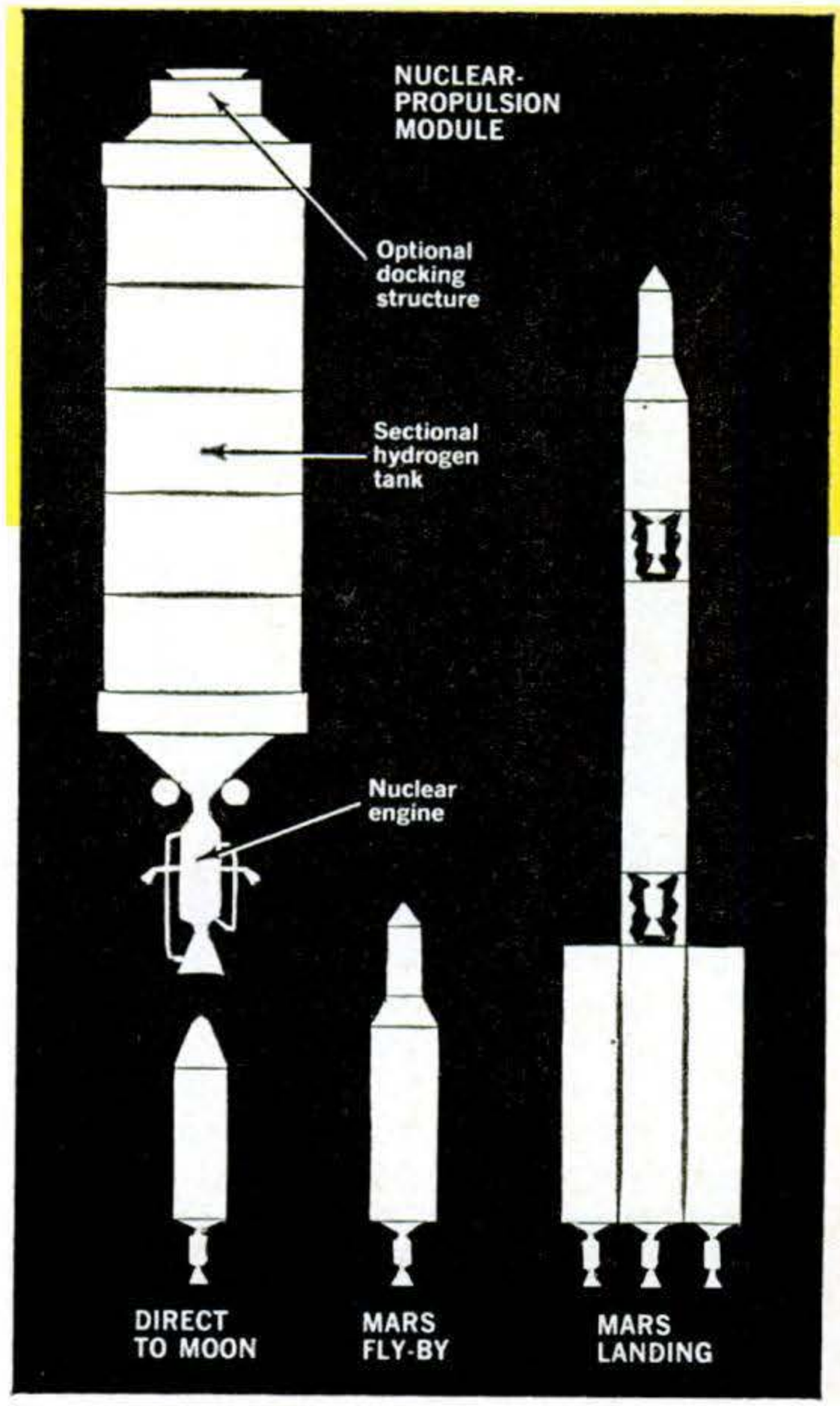
TURBINE

PUMP

HYDROGEN SUPPLY

NUCLEAR REACTOR

TURBINE-EXHAUST NOZZLE



Energy Commission (AEC) and the National Aeronautics and Space Administration (NASA).

How NERVA will work. Heart of the NERVA engine will be a nuclear reactor built of graphite, and perforated by thousands of tiny channels through which hydrogen is pumped. Uranium 235, embedded in the graphite, forms the reactor's fuel. Its neutron chain reaction releases a continuous heat flow of five million thermal kilowatts, and the core of the reactor glows white-hot.

Continued

Manned spacecraft for missions shown can be made up of one or more nuclear propulsion modules, each consisting mainly of NERVA engine and tank holding 50 to 175 tons of hydrogen propellant.

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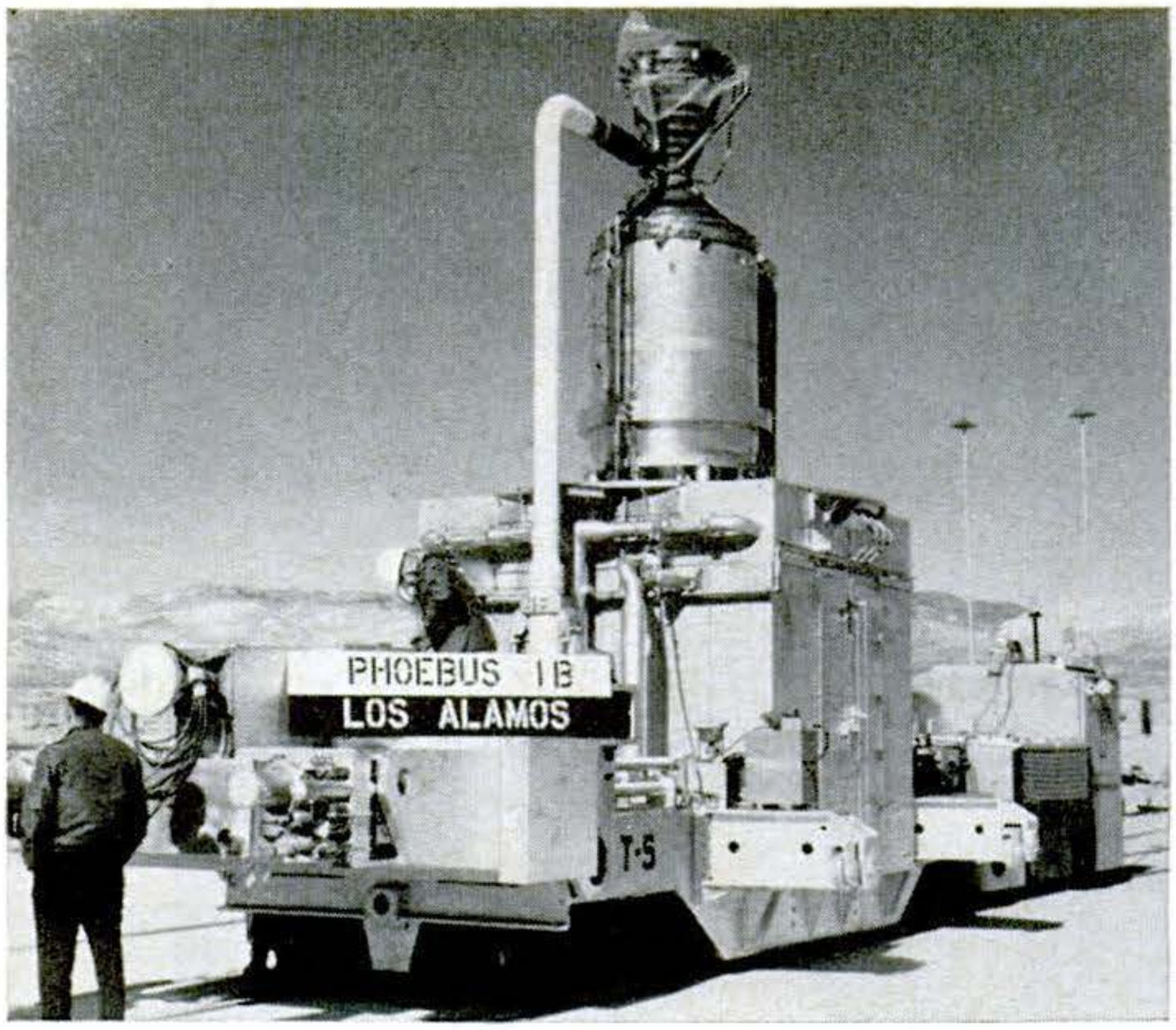

Nuclear-rocket reactor Phoebus 1B, seen atop rail car, developed 2,000,000 hp. and proved NERVA engine feasible in test this year.

As hydrogen streams through, at a pressure of several hundred pounds to the square inch, it is heated to more than 4,000 degrees F. Expanding, it spurts flamelessly from a conventional De Laval nozzle at 25,000 to 28,000 feet per second (17,000-19,000 m.p.h.).

The superiority of a nuclear rocket engine like NERVA lies in the fact that the exhaust is pure hydrogen, lightest of all the gases. The lighter the atoms of a propellant, the greater the exhaust velocity—and the more thrust produced for every pound of propellant expelled.

In terms of propellant economy, NERVA is expected to be about twice as good as our best chemical rocket engines burning hydrogen and oxygen, and about three times as good as the best solid-propellant rockets.

Problems to solve first. Developing such a radically new engine raises many questions requiring thorough research to answer, before design of a flyable engine system can even begin:

- How will the graphite hold out under the erosive and corrosive effect of high-pressure hydrogen, rushing at tremendous speed through the reactor's channels at white-hot temperature? Will sudden heating and cooling, during start-up and shutdown, crack the graphite?
- How large must the reactor be, to permit a continuous heat flow of five million thermal kilowatts from the graphite core to the hydrogen?
- What is the most effective way to cool the exhaust nozzle and the reactor's pressure vessel with the hydrogen, before it enters the reactor core?
- How must the control rods that regulate the reactor's heat be linked to the hydrogen-flow control, which governs the amount of propellant that absorbs and carries away all that heat?
- What safety features and procedures must be provided, to avoid a disastrous nuclear accident?

Answering these and other questions has been the aim of the joint AEC-NASA program, known as Project Rover and directed by the Space Nuclear Propulsion Office. The bulk of the pioneering work in reactor technology was done by AEC's Los Alamos Scientific Laboratory in New Mexico. NASA's Lewis Research Center concentrated on non-nuclear problems such as how to build a liquid-hydrogen-cooled exhaust nozzle—or a liquid-propellant pump powered by a turbine that would be driven by warmed-up gaseous hydrogen, tapped off the nozzle's cooling passages.

Experimental nonflying Rover reactors have served for trials. First came Kiwi-A, named after New Zealand's flightless bird and successfully tested in 1959. A dozen reactors of improved design have since been tested, all at the Nuclear Rocket Development Station on Jackass Flats, in Nevada. Progress shown by the performance of Kiwi-B4D in May, 1964, led to more-powerful reactors of a new series called Phoebus.

In June, 1965, the Phoebus 1A reactor ran for over 10 minutes at full power of about 1,100,000 kw., or nearly 1,500,000 hp. Last February, a similar sized but more powerful Phoebus 1B reactor was operated for 45 minutes. During 30 minutes, the maximum time planned, it de-

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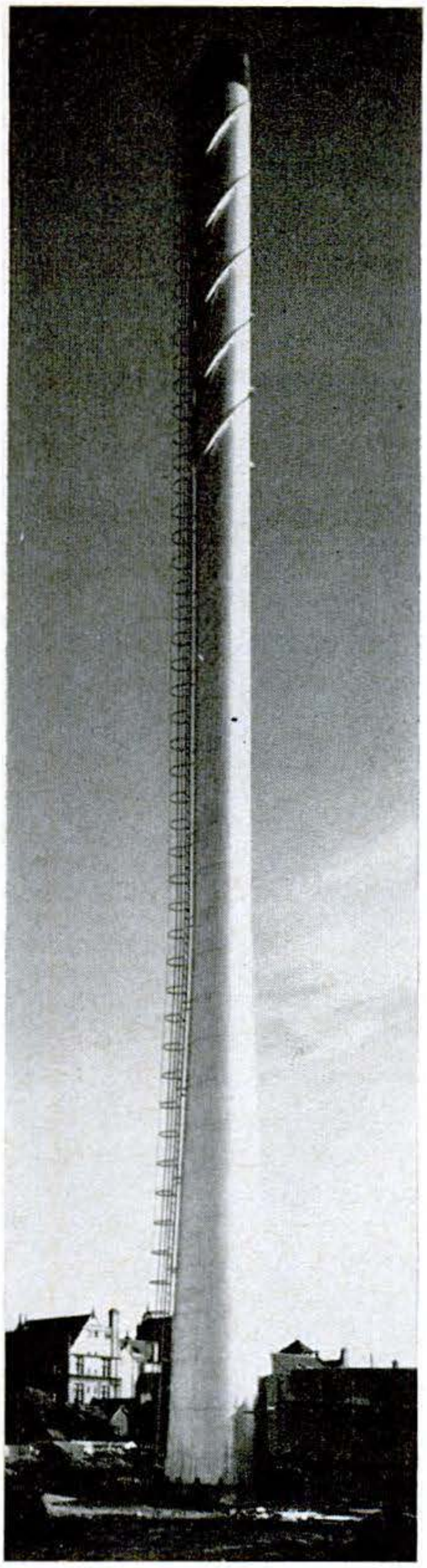
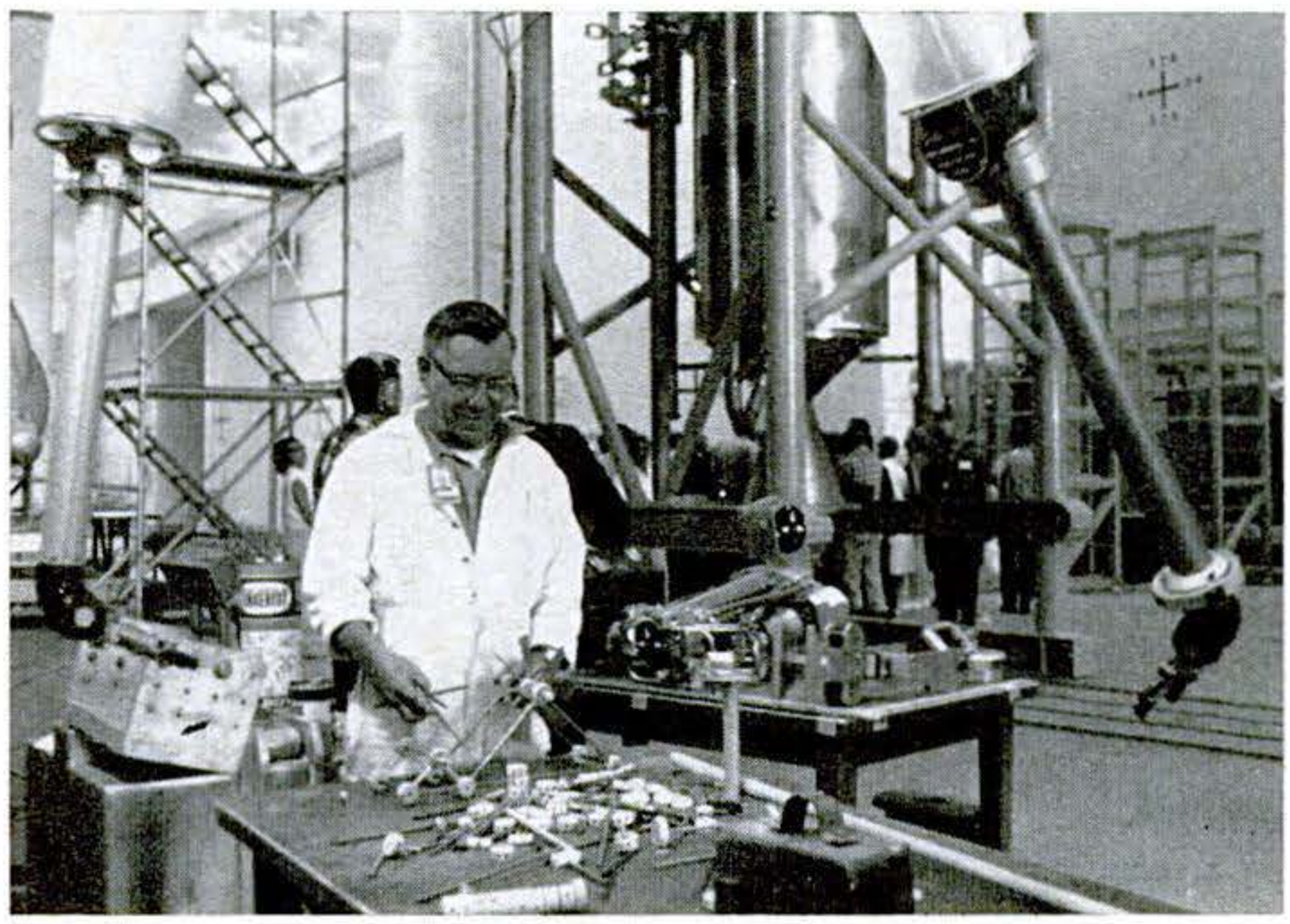


Aerodynamic smokestack

At first glance, it looks as if somebody was trying to get arty with a plain, old smokestack. Actually, those spirals on top are welded-on strips to break up the air flow in wind, upsetting the to-and-fro forces that cause smokestacks to sway. A British idea, it was born in wind-tunnel experiments.

U.S. Forest Service finds replacement for mule

Mules have always been used to haul loads on the 88,000 miles of trails in the National Forest System. Now their days may be numbered. This three-wheels-in-line, gyro-stabilized "gyro carrier" shoulders as much as four mules and moves at five miles an hour. An 18-hp. engine drives both wheels and gyro, the latter at 5,500 r.p.m.



What! Tinkertoys in a nuclear-propulsion lab?

Yes, exactly that. First, take a look at that thing in the background. It's one of the huge, remote-controlled robots that take apart the "hot" nuclear engines being experimented with at NASA's Jackass Flats lab in Nevada. Operators of the robots practice putting Tinkertoy parts together to improve their manual dexterity.

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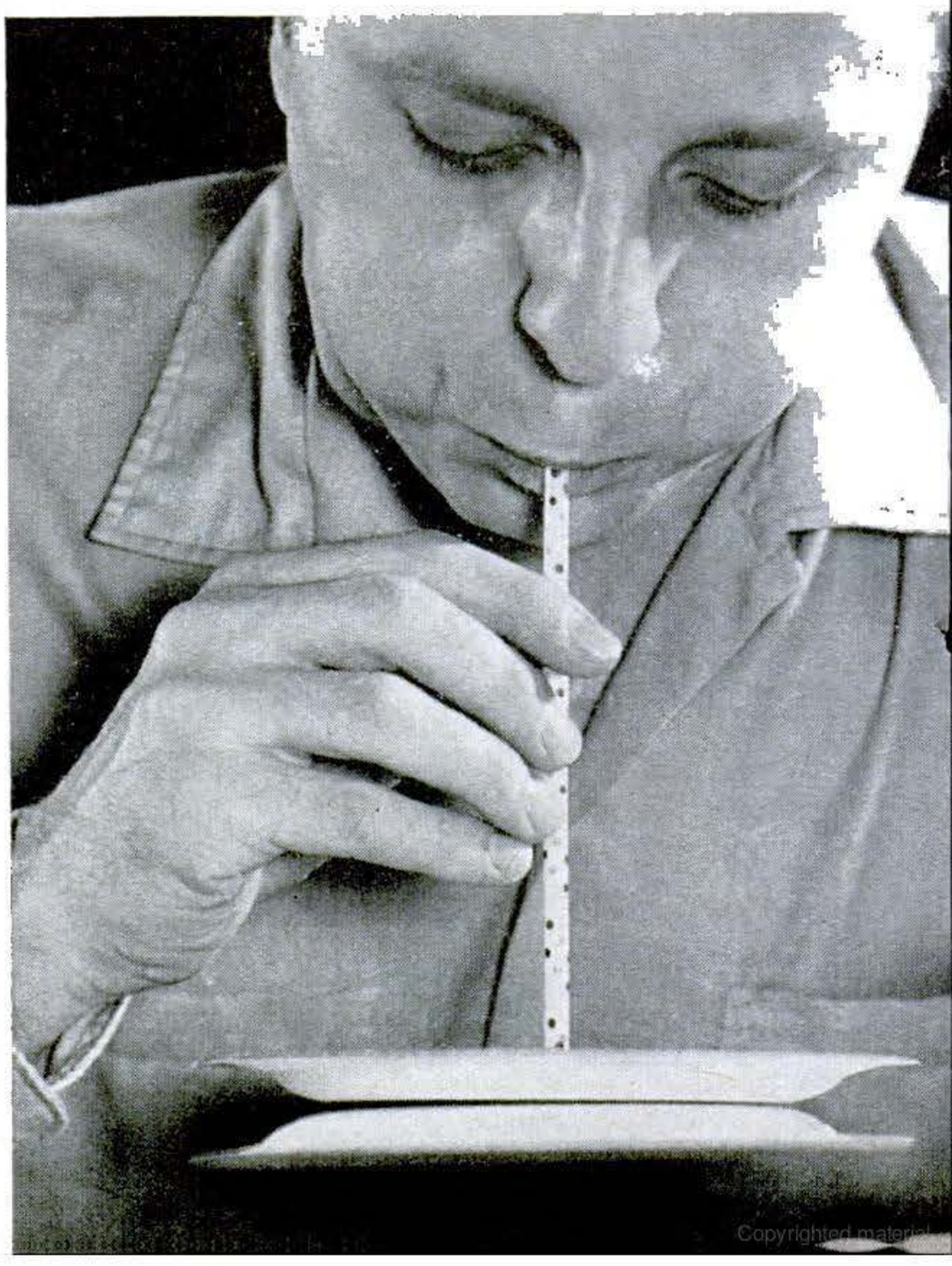
Two simple stunts prove a famous law

Physic

By KEN SWEZEY

A toy balloon, supported by a table fan's breeze (left), demonstrates Bernoulli's paradox in action. Point the fan straight up, then drop the balloon into its breeze—weight the balloon with paper clips, if necessary, to keep it within two feet of the fan. The balloon will stay locked in place above the fan—dancing up and down, but never falling away—even though you now should tilt the fan to one side.

To demonstrate aerodynamic lift, force-fit a soda straw into a small hole made in the center of a paper plate. Place another plate directly underneath, face down (as shown below). Center this plate by passing a straight pin through its center, with the protruding point entering the soda straw. Now blow through the straw (right). The bottom plate jumps up against the top one. Can you explain why?



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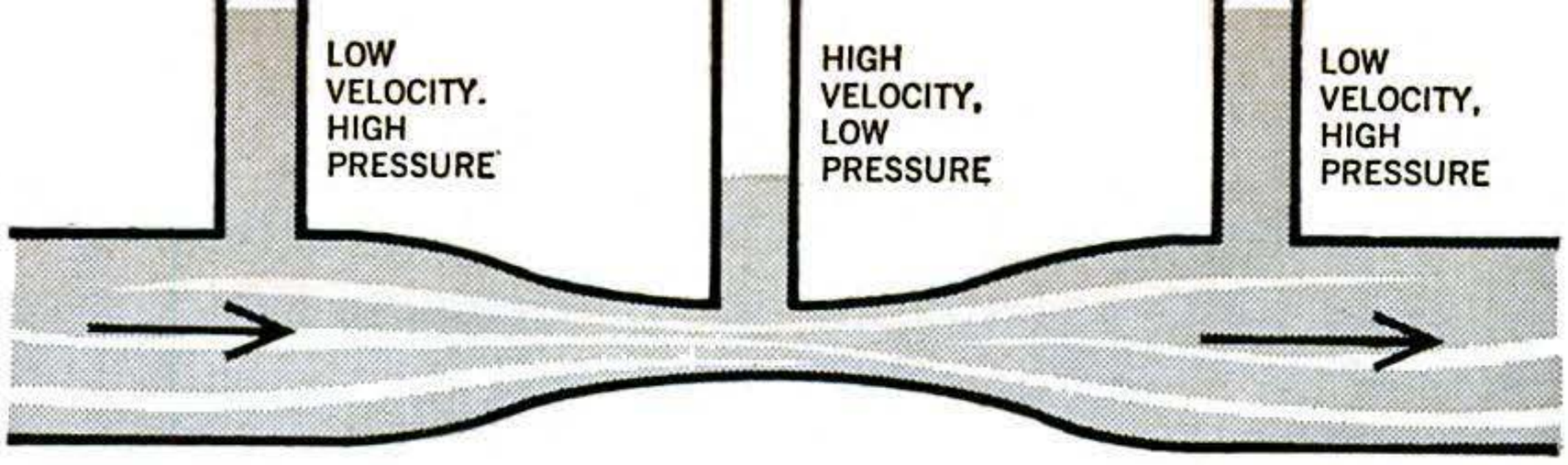


Bernoulli's apparatus was a tapered tube, plus three manometers (pressure-measuring tubes). With a liquid flowing through the throat, center manometer shows a low pressure reading since it monitors liquid's high-velocity path.

for Fun: Bernoulli's Paradox

Why do houses in the path of a tornado explode outward? Why do curve balls curve? How does the carburetor in your car breathe an air-gas mixture into the engine? What holds a giant jetliner up in the thin air at high altitudes?

All these seemingly diverse effects can be explained by a single paradoxical law of science discovered by the distinguished Swiss mathematician, Daniel Bernoulli, back in the 1730s.

In substance, the law goes like this: Increase the velocity of a stream of fluid (such as air or water) and the pressure inside the stream is decreased.

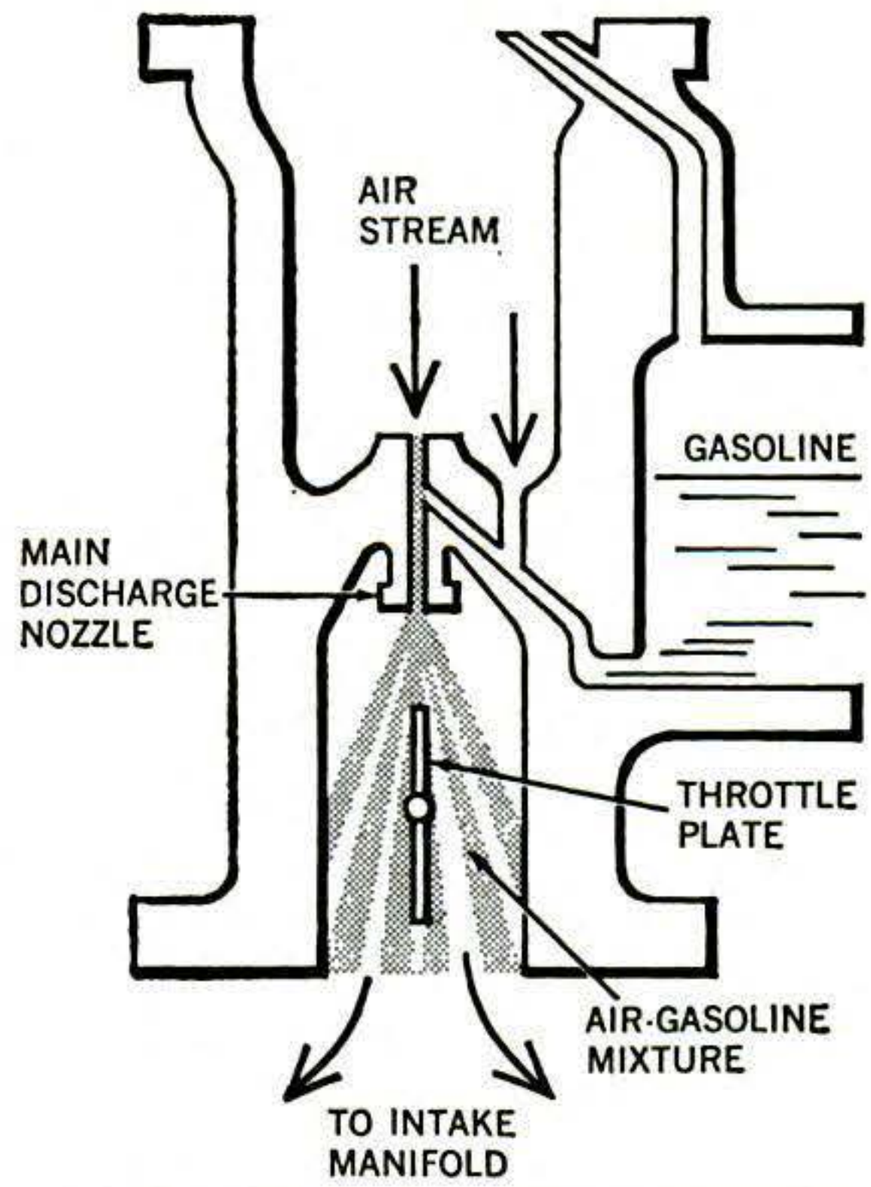
That's why a house in the path of a tornado blows outward—the still air inside the house is at a much higher pressure than that of the wind whirling past it at 300 m.p.h.

You can prove the point with an updated version of a demonstration first described by Hero of Alexandria some 1,700 years ago. Support a toy balloon in the breeze from an electric fan, as shown on the facing page. When you tilt the fan to one side, the balloon still stays in the breeze, seemingly defying the laws of gravity. This occurs because air streaming at high velocity around the sides of the balloon, or sphere, is at lower pressure than the still air outside the breeze. Therefore, whenever the balloon reaches the edge of the breeze, the still air pushes it back.

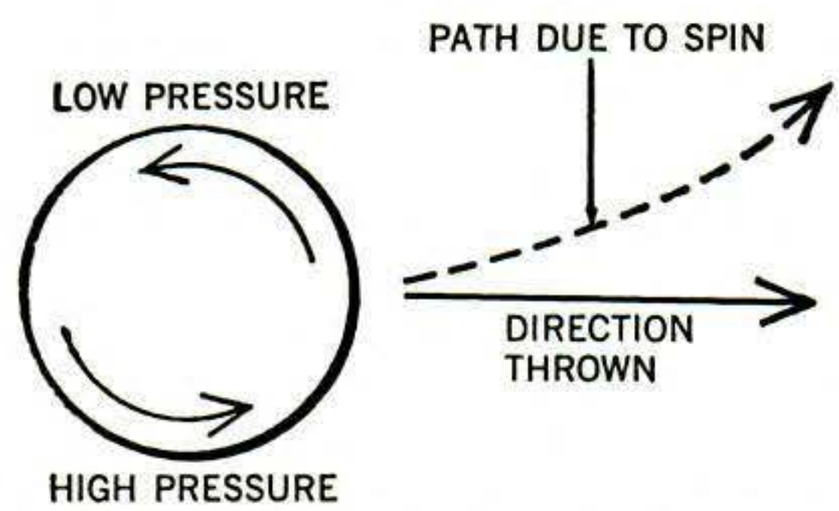
Although today we think of the Bernoulli effect chiefly in connection with high-velocity air, Bernoulli discovered it while studying the flow of liquids through pipes (see diagram of his apparatus at top of this page).

What makes planes fly? Perhaps the greatest application of the law has been in explaining aerodynamic phenomena. Planes fly because the upper surface of their wing is curved in such a way that the air traveling over each wing has to move faster—and so has a lower pressure—than that under the wing. The difference in pressure between

[Continued on page 210]



Inside a typical automotive carburetor, air is sucked through a venturi (a tube with a constricted throat). The resultant low-pressure area draws up gasoline from a small reservoir to create an explosive air and gas mixture.



A curve ball thrown by your favorite pitcher "curves" because of a thin film of air that clings to the baseball's surface. The secret is the spin that he gives the ball—the spin creates a low-pressure area close to the ball's surface.

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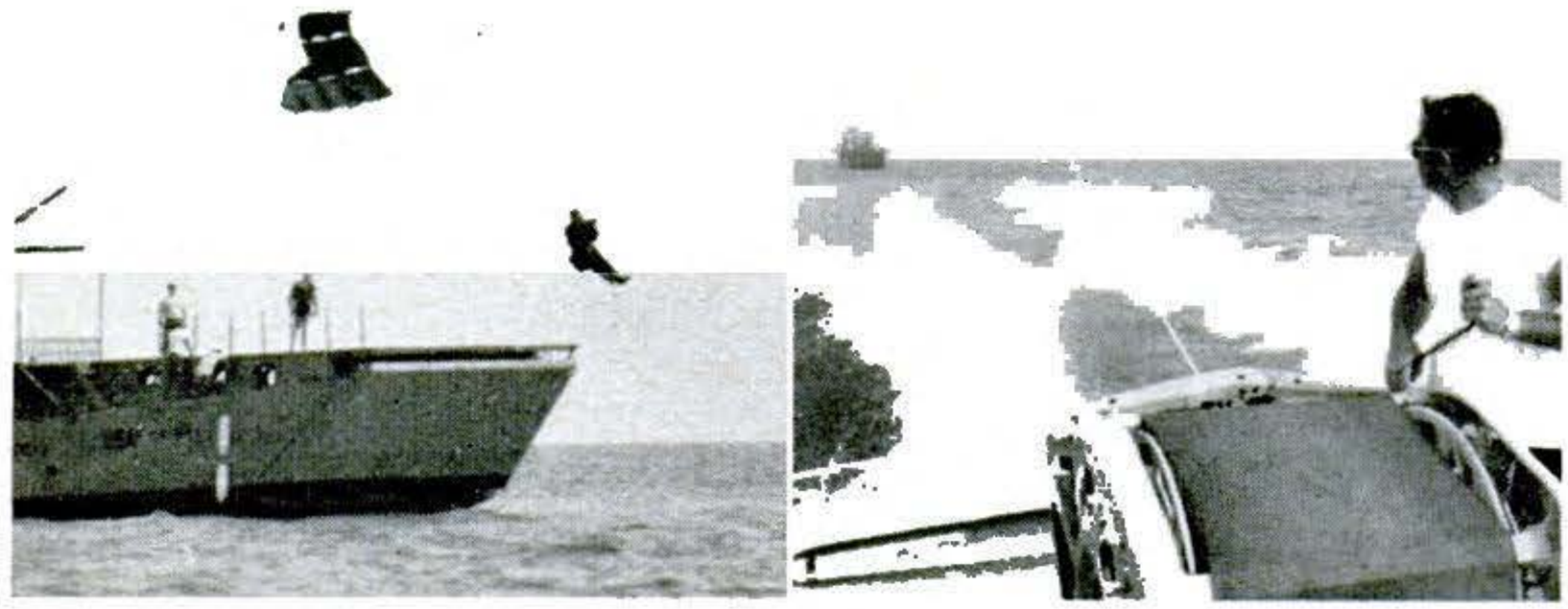
Our go-anywhere, do-anything reporter takes a 50-story plunge into the Atlantic and battles sun, thirst, loneliness, and fear during an Air Force sea-survival course



Parachute billows out over reporter Bob Gannon as he rises from carrier-like deck of launch boat (left). Behind tow, he rises to altitude of 500 feet (center), then floats down to settle on the empty, open sea (far right) to test his ability to survive.

They Dropped Me in the Middle of the Ocean ...and Left Me There

By **ROBERT GANNON** PHOTOS BY JIM WALLACE

There I was, bobbing about somewhere out in the Atlantic. Alone. A breeze was coming up, the waves were getting larger, and I was considering, quite seriously, getting seasick.

I was taking a sort of final exam in the Air Force's sea-survival school, where candidates are set adrift for half a day to get an idea of what it's like to be utterly alone, to have the whole world consist of only ocean and sky, and the dot that's you on your little yellow raft.

The school, operating out of Homestead AF Base, Fla., was formed because in a typical peacetime year, some 400 Americans, most of them military, must bail out or ditch in the ocean. Only 36 percent come through alive. But since the school was set up, of 35 graduates forced to bail out over water, not one who hit the water alive died there.

The school was formed and is run by Major Wayne Williams, who told me: "A pilot with eight years' experience is worth about $800,000. A year after losing an *aircraft* we can have another. But it takes eight years to replace that man. This survival course is insurance.

"Here in the school," he adds crisply, "we've lost only one man. Heart."

To find out what fliers who go through the school learn, I joined a regular class.

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I was the only civilian. The course is geared to the military, but the lessons I learned can be used by anyone who is adrift at sea.

In the classroom we sat through lectures in such handy techniques as performing emergency tracheotomies and burying dead at sea. Some of the gems picked up:

- Life expectancy in 30-35 degree water is about 45 minutes; in 40-45 degrees, three hours; 60-70 degrees, 12 hours.
- In a sea-survival situation, the first and last few minutes are potentially the most dangerous.
- You can make a 50-foot fishing line with a 100-pound breaking point from a yard-square piece of canvas. You unravel, then roll or twist eight to 10 strands between thumb and forefinger and progressively add new strands.
- Some 88 percent of rescues are made within 24 hours. If nobody finds you by then, tough; settle down for a long wait.

Getting into the water. To teach water entry, Williams and crew have two delightful gadgets. One is a 15-foot platform you jump off as it chugs across the water. The other is a 53-foot tower with a cable you slide down.

By the time I climbed the open wood-

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"My knees were wobbly, my knuckles white"

Air Force instructor gives Gannon (foreground) the word on how to don a parachute correctly prior to drop into ocean.

Waterproof suit is something less than watertight, Gannon learns after a dunking. At right he's shown correct way to empty water out of the suit: stand on your hands and let it run down your neck.

plank stairway to the five-story-high tower, my knees were wobbly, my knuckles white from clutching the banister, and my inclination was to grab the waiting instructor and hug. Fortunately, I resisted the impulse.

The instructor gently prodded me to the edge of the plank, turned me to face him, buckled my harness to an overhead rig, and shoved. I fell into space; then, jerked upright by the harness, whizzed out and down, overhead pulley squealing. Horrified, I saw that I was facing the water. That's wrong—I had turned. You're supposed to go in backwards. Too late; I landed in a white splash of salty foam, and inhaled a good percentage.

The second run was even more fun: I went down blindfolded to simulate a night jump.

That moving 15-foot platform is equally amusing. It's built onto a garbage-scow-like LCM, and its main purpose is to simulate the impact of a parachute entry and the chute's dragging.

"Go!" yelled the instructor. I squinted my eyes, gingerly stepping into space. You know that sinking feeling in your stomach? I got it. *Smack* into the salt I shot, my preserver whacking me in the face as I went under. Forgot to hold my arm over it.

Coughing and sputtering, I bobbed to the surface, tried to get my bearings, and suddenly was snapped backward. I had forgotten again—this time that I was still tied to the boat. Somehow I also forgot to hold my feet apart and my head forward, the correct position for parachute dragging, so over and under the waves I porpoised.

I finally found my release rings, yanked them forward, and—blessed relief—I stopped, just as the pickup helicopter flapped up.

From a cave in its side an anchor-like device spiraled down to me. I remembered to let it touch the water first before I grabbed it—it can develop a static charge of 7,000 volts at one or 1½ amps. The noise of the chopper was totally disorienting. And water filled the air with stinging, blinding droplets.

Fun on a raft. The checkout of the 20-man raft was another funtime, this one filled with rollicking good fellowship. The deal is, you toss the rolled-up raft overboard, the CO_2 cartridge blows it up, and the batch of you (16 in our group) jump ship, climb into the raft, and make your-

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selves at home for the next couple of hours.

Well, the Air Force may label it a 20-man raft, but a dozen pygmies couldn't be comfortable in one. Feet are in armpits, elbows in mouths, as you attempt to use the equipment.

I put the survival case overboard to make some room. It kept on going; I thought someone else had tied it to the boat. One enterprising student had brought along a tiny fishing kit, but all he caught was his buddy's earlobe. Someone accidentally jabbed a tiny hole in the raft's bottom, and we found that the metal patches wouldn't work; the manufacturer had skipped one step and failed to bore an essential hole. The water continued to seep in.

After an hour crammed in a raft, you don't care much for your fellow man —particularly when he begins to throw up from seasickness.

Takeoff by parasail. The literal high point of the week's entertainment was reached in a parasail. This looks like a parachute, is hooked to the parachute harness, and pulled with a tow rope at 25 m.p.h. by a car (for land instructions) or boat, with you attached to the chute. At the apex, you unhook the towrope and float gently to earth. Easy. Perfectly safe.

In theory. But the first man in our group to try it—a tough Commando colonel—rose 20 feet or so, when a gust of wind hit the chute. He swung down, clumped to the ground, bounced once, broke two ribs, and collapsed a lung.

The following day we tried it over water.

The takeoff platform, another converted LCM, looked like the deck of a miniature aircraft carrier. Far out ahead a 35-foot launch paced the platform. The tow rope, slightly tensed, was hooked to my harness. Behind me, instructors held the parasail in readiness. On my rump was strapped a folded-up raft, and a survival kit was built into the seat of my flight suit. I braced my feet and waited apprehensively.

"Canopy's set," crackled an electronic voice. "Lines in. Stand by. Take up slack. Hold it . . . hold it . . . Execute! Execute!" An unfortunate choice of terms, I thought, as I began to trot forward, pulled by the tow rope.

Suddenly I was treading air above the gradually shrinking whitecaps. But I couldn't enjoy the scenery. I had to remember what to do and in what order, and my mind was disordered.

[*Continued on page 204*]

"The whole world consists of ocean and sky"

One thing they don't teach you at survival school, bespectacled reporter discovered, is how to squeegee your glasses.

Gannon learns the hard way what it's like to be dragged through surf by a parachute after jumping off a 15-foot moving platform. It took a lot of guts to do the job.

Pickup by helicopter ends the long ordeal for our fearless reporter, but noise and blinding, stinging droplets churned up by the chopper are disorienting, he says.

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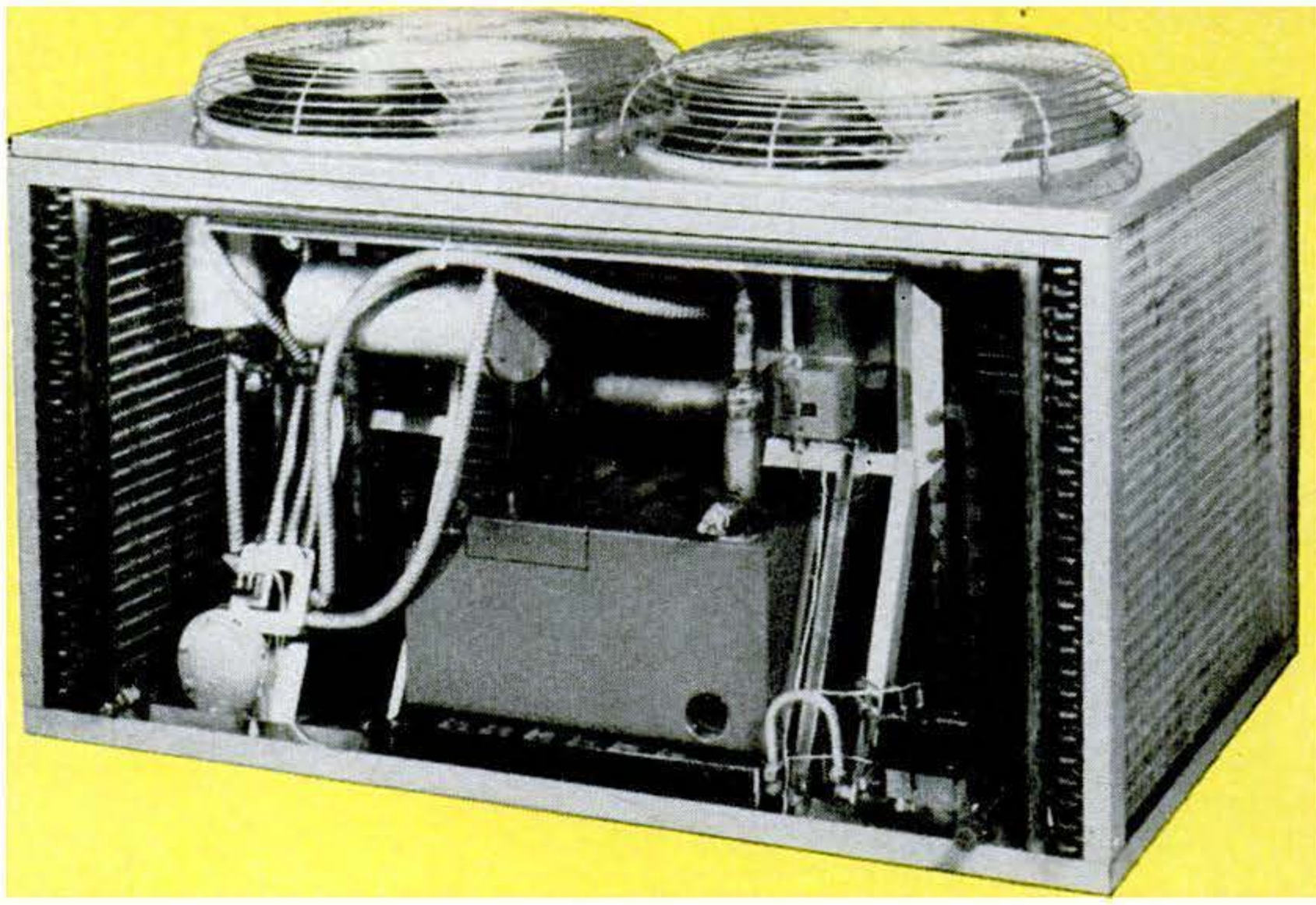
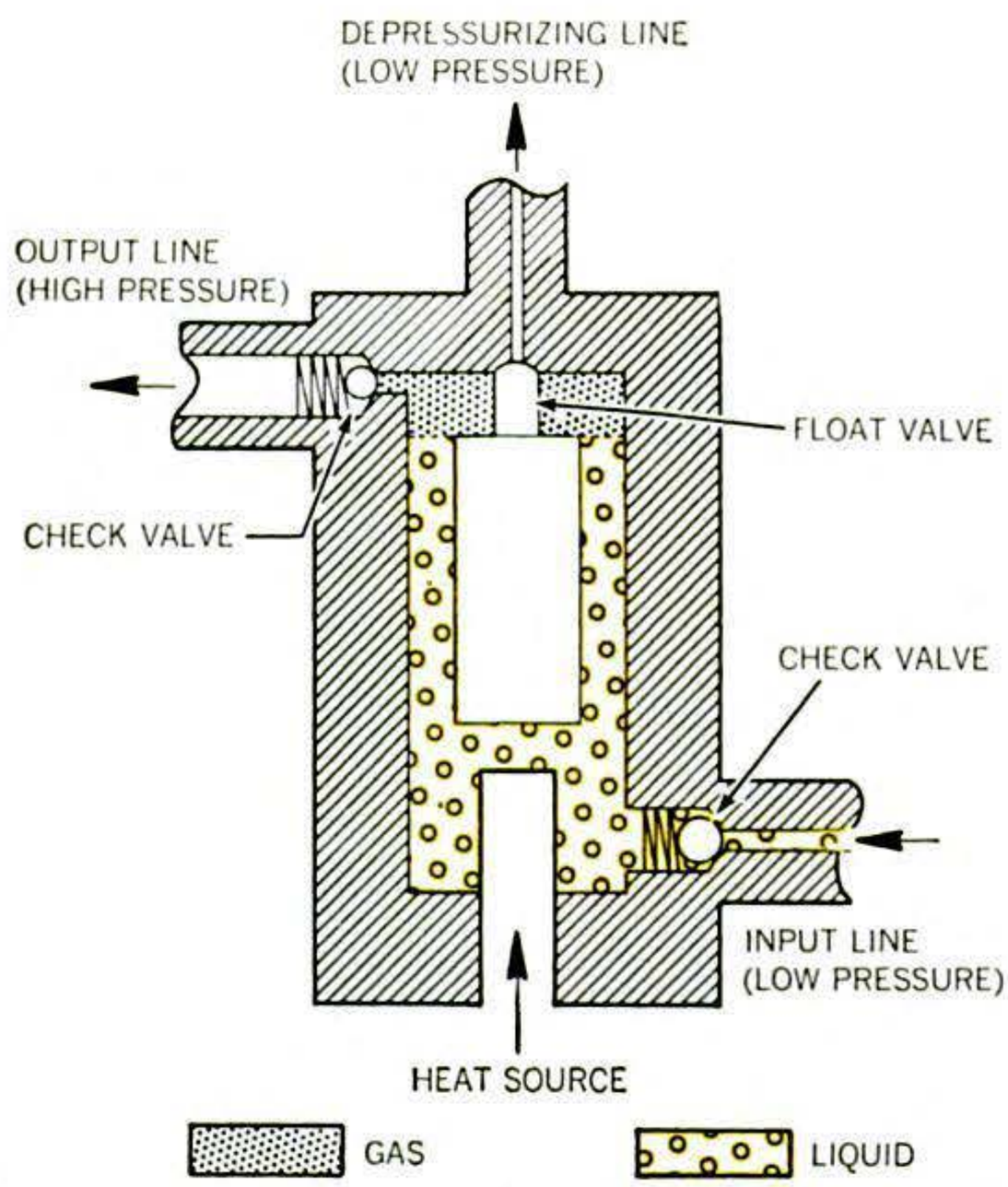


Rough prototype of Conductron's revolutionary system, which both heats and cools, is shown at left. Units to provide year-round comfort yet cost little more to install and operate than a conventional gas furnace are foreseen for the future. They would burn about the same amount of gas to cool a house in summer as to warm it in winter. First three-ton units (of 96,000 BTU per hour for heating) are 24 by 54 inches, 31 inches high, weigh 460 pounds.

This Gas-Flame Air Conditioner Both



Cycle of gas-piston compressor: Liquid refrigerant, vaporized by heat, is released to output line at particular pressure. Float valve bleeds off more vapor, depressurizing chamber to bring in recycled liquid refrigerant. "Piston" is an effect, not a device.

A revolutionary new concept in home heating and air conditioning has been developed as a result of Apollo space research. While trying to cut down the size of a two-part heater and cooler for the capsule, Conductron Corp. came up with the idea for a simple, economical, single-package heater-cooler, and, with the American Gas Association, is now adapting it for home use.

The natural-gas unit, which may well replace conventional heating and air-conditioning equipment, will offer the home owner these advantages: 1) low initial cost; 2) reasonable operating costs in most areas; 3) simple construction and few moving parts for easy maintenance; 4) no chimney needed.

When can you buy one? Target date for marketing the units is 1969, and some are now undergoing field tests. The capacity of the first is three tons (cooling) and 96,000 BTU per hour (heating). Both 2.25- and 4.25-ton models, with commensurate heating capacities, are also in the works.

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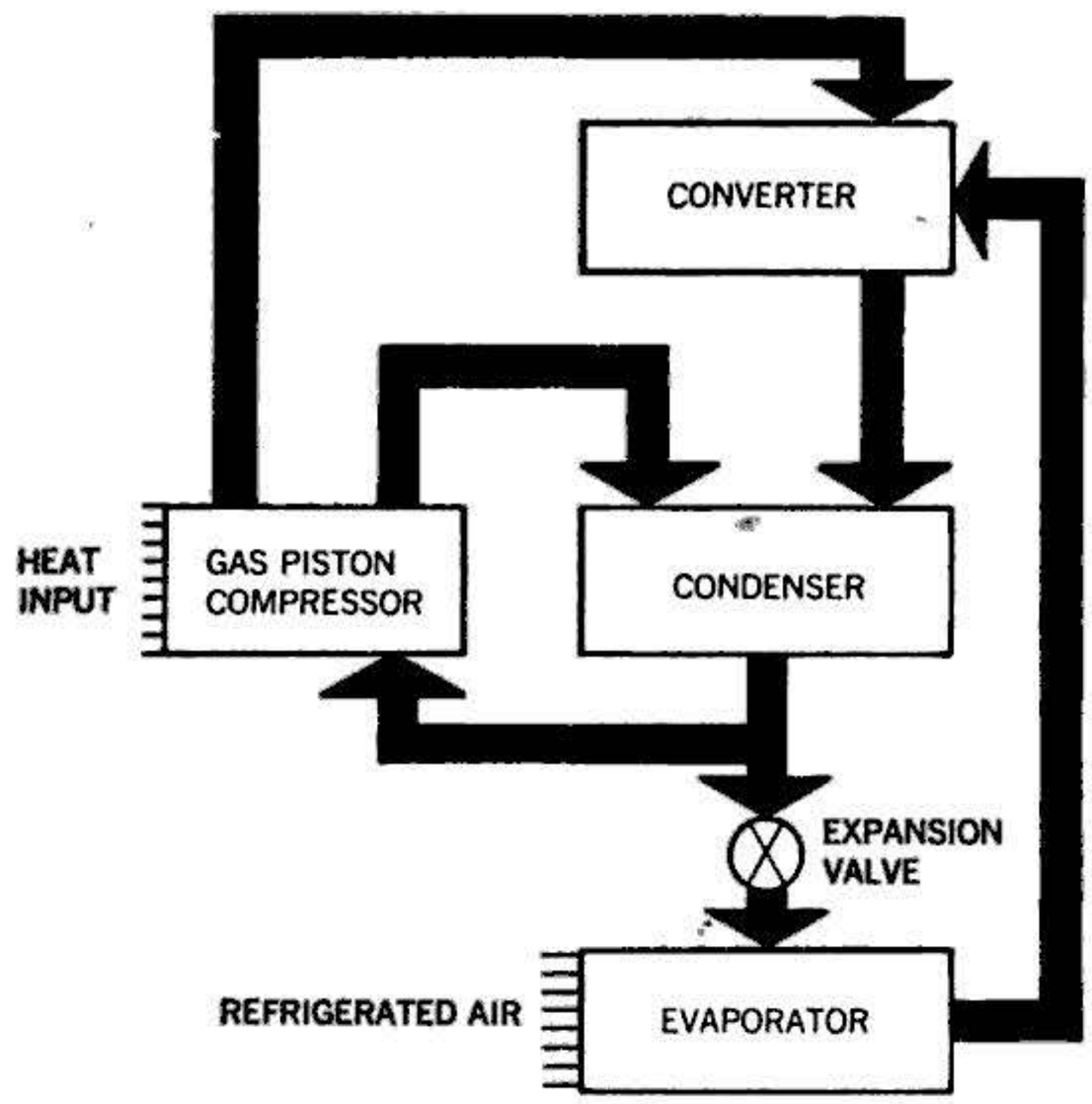
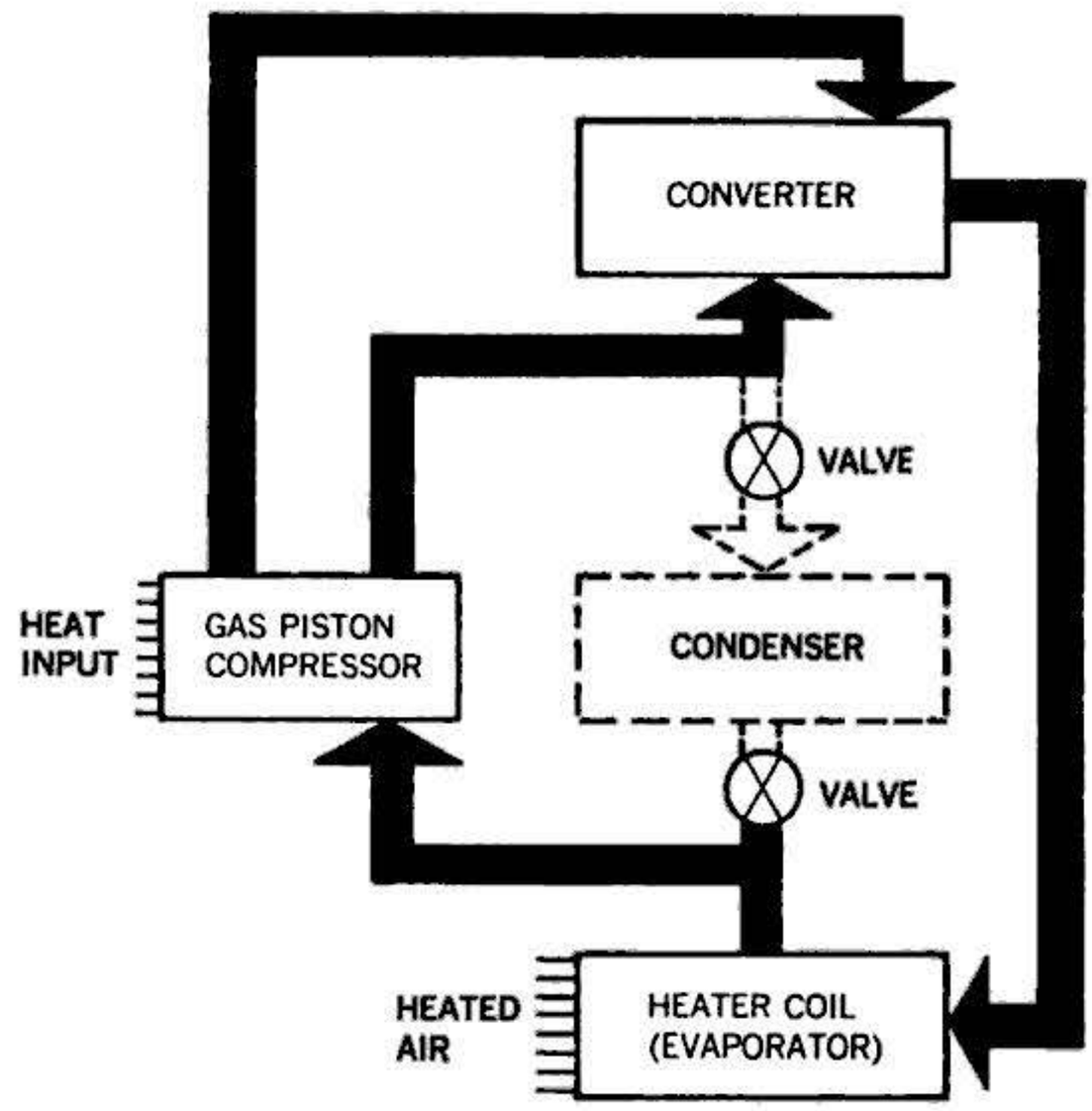


In cooling cycle, refrigerant is vaporized and pressurized by gas-piston compressor; strong stream of gas compresses mix of high- and low-temperature gas, through venturi effect, in converter.



In heating cycle, the condenser is bypassed and the heated gaseous refrigerant goes directly to the evaporator, which now becomes a heater coil that sends heated air into the house.

Heats and Cools

By ROBERT W. DENNISTON

How it works. Heart of the unit, analogous to the motor in an electric refrigerator, is a patented "gas-piston compressor" in which heat energy changes liquid freon into a flow of high-pressure gas. This hot, strong flow powers a conventional vapor-compression refrigeration loop (exactly like that in an electric refrigerator) for cooling, or simply releases heat to inside air for heating.

When internal pressure in the gas-piston compressor ("piston" refers to the relationship between liquid and gaseous freon, not to a mechanical piston) is high enough, the gas is released through a check valve to the output line.

The remaining gas in the gas piston is bled off when almost all the liquid freon has been vaporized. As shown in the drawing at left, a buoyant float valve opens the depressurizing or bleed line as the liquid level decreases. This lowers the gas pressure in the chamber, closes the outlet valve, and permits low-pressure input of liquid returning from the system. Liquid level and pressure build up again, and the cycle repeats itself.

Cooling. The converter, which has no pump, does the compressing in the vapor-compression refrigeration cycle. It mixes the hot, high-pressure gas with cool, low-pressure gas from the evaporator, and then ejects it (raising its pressure), by using a venturi effect created by the incoming stream of high-pressure gas. Next, the gas, now at intermediate pressure and temperature, heads for the fan-cooled condenser. It gives up its heat to the outside air and liquefies.

A portion of the liquid freon flows through an expansion valve and into the evaporator where—as in an ordinary air conditioner—it vaporizes to cool the house. The remainder of the liquid is returned from the condenser directly to the gas-piston compressor, where it is needed to power the system.

Heating. To turn the unit into a heater, the condenser is simply closed off. Now, hot freon flows directly from the converter to the "evaporator," which becomes, instead, a heating coil.

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WORLD'S MIGHTIEST

Satellite trucks and Super Tender (right) are part of the five-truck Super Pumper system.

Heart of Super Pumper is 2,400-hp. diesel marine engine in trailer driving a centrifugal pump (open compartment).

Monster 2,400-hp. pumper can throw nearly 9,000 gallons of water a minute

FIRE ENGINE

By PAUL DITZEL

One cold December night, when a blazing candy factory cast an orange glow across the sky, the crew of the most powerful fire-fighting vehicle ever built responded to their first alarm. For the first time, New York's Super Pumper, a tractor-trailer carrying an 8,800-gallon-a-minute pump powered by a 2,400-hp. diesel engine, would be tested.

As it pounded down city streets, its four satellite trucks, each mounting water cannons capable of demolishing a burning building, pulled into place. Sirens screaming, the Super Pumper halted three blocks away from the fire, in a neighborhood where there was enough water—from three separate hydrants—to supply it. It began sucking thousands of gallons through its large inlets, into its six-stage centrifugal pump, and out again through big flexible lines.

The 2,400-hp. turboblower diesel whined, its pitch so high that the four crewmen wore earmuffs and communicated through sound-powered telephones.

At the fire, 3,000 gallons of water a minute surged from satellite No. 2's big three-inch cannon, battering the flames into submission in less than 10 minutes.

"We were awed by the splashing noise that first time when we used the Super Pumper," recalls Chief Maurice Ratner. "It was like Niagara Falls."

Although the need for pumpers that could handle big volumes of water at effective pressures had long been recognized, there were no pumps that would do the job without buckling the pavement.

The right engine and hose. Then the British Admiralty developed lightweight high-power diesel engines for its patrol boats. U.S. Navy research made possible lightweight hose that would stand up under pressures of 1,000 pounds per square inch (ordinary hose operates at about 175 p.s.i. maximum).

Work on designing and building the Super Pumper system began in 1963, and in late 1965 it went into service: the Super Pumper, the Super Tender, and three satellite hose tenders. At 43 feet long, 11 feet high, and eight feet wide, the pumper is about the size of a hook-and-ladder truck and is similarly maneuverable. It weighs 34 tons, has 18 14-ply tires. Pulled by a four-stroke 255-hp. Mack diesel engine, it can do 40 m.p.h.

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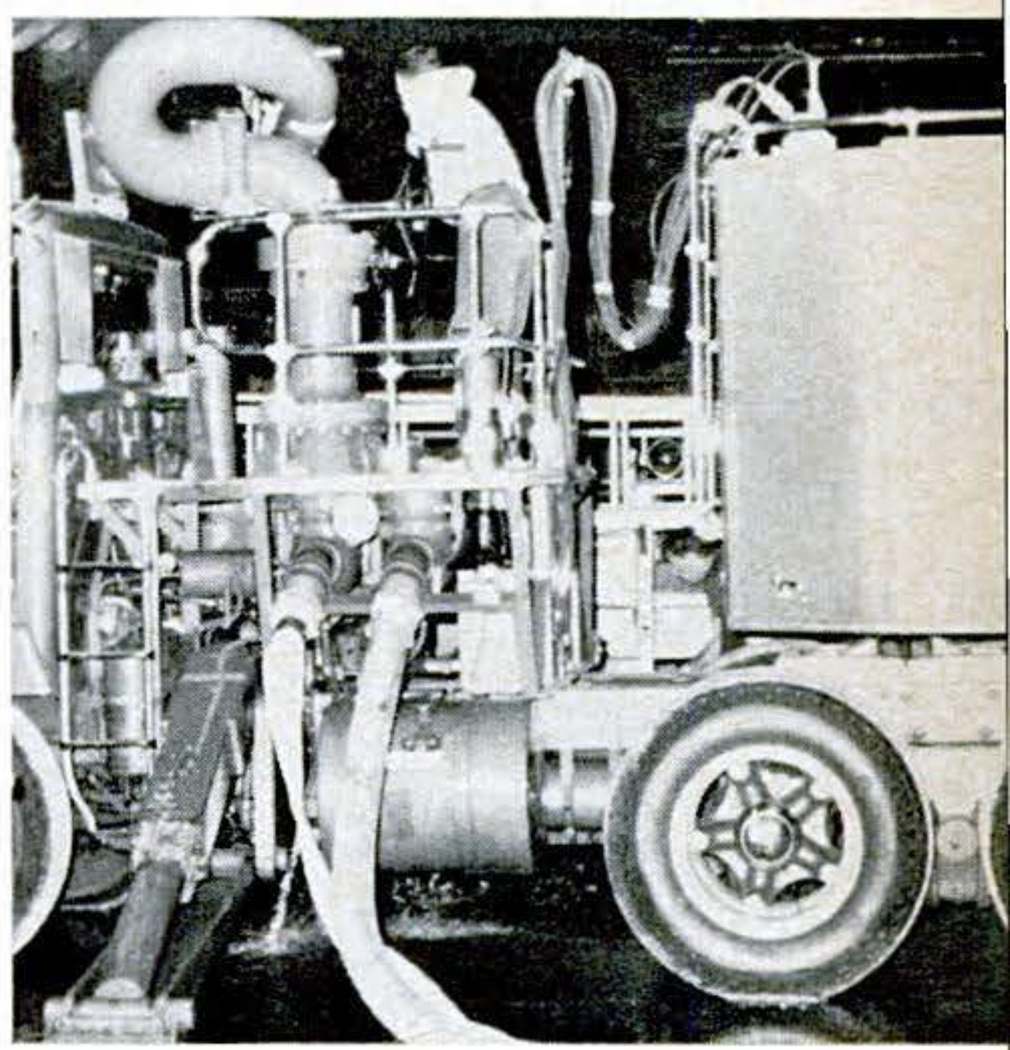
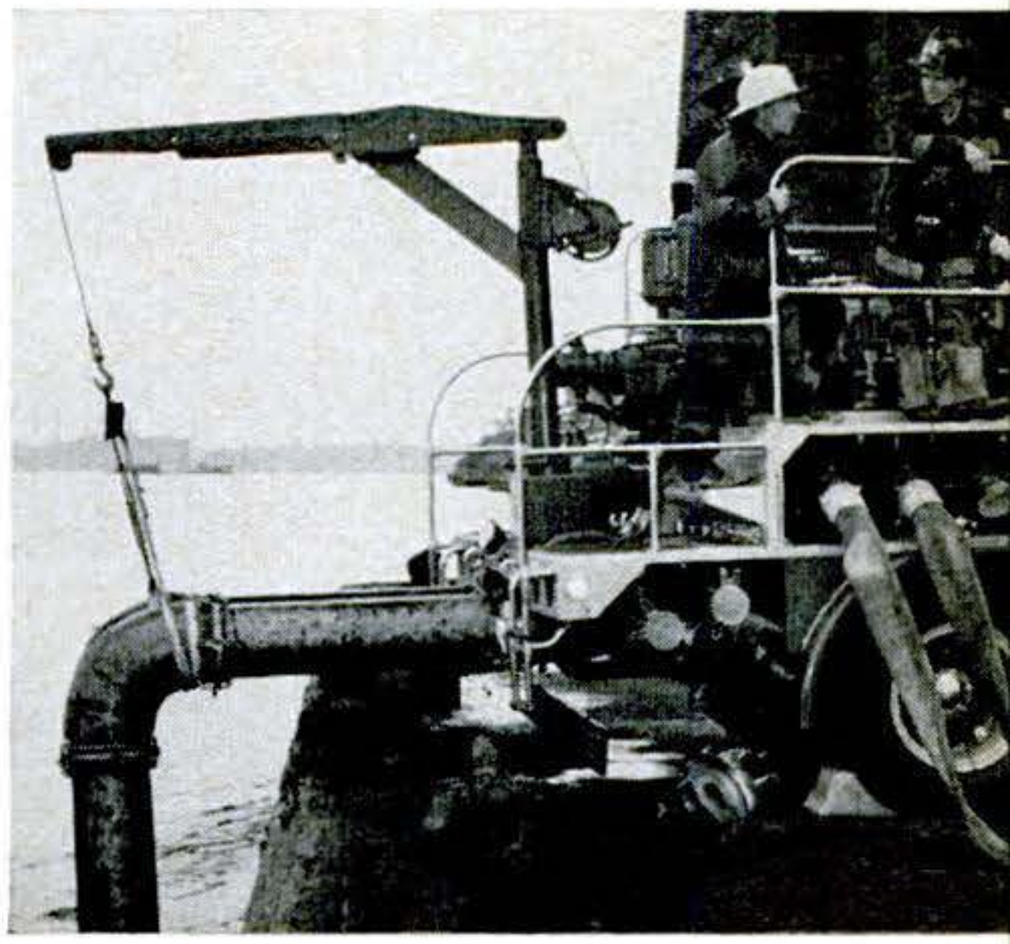
Crewmen wear headsets, talk by phone to be heard. Huge pump is seen in trailer; instrument panel below; input, output hoses at rear.



Super Tender uses outrigger (left of hoses) to keep blast of water cannon from tearing it loose. Large curved pipe at top leads to cannon.



Large inlets at rear of pumper permit use of river or ocean water for fire-fighting. Pump is made of stainless steel to take salt water.

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PS Picks 13 Winners

Which cars will be the stars in '68?

After we had looked at all the new models, we started to pick favorites. Cars that turned us on. Exciting all-new cars and '68 versions of cars that impressed us in '67. Cars with new styling and important engineering news. Cars that stand out from the ordinary. Cars we believe will impress you. Winning cars.

By JAN P. NORBYE / *PS Automotive Editor* **and JIM DUNNE** / *PS Detroit Editor*

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JAVELIN *by American Motors sets a new styling trend for the nation's number-four auto maker. The all-new unit body comes in only one style: semi-fastback four-seater coupe. Engine range for Javelin starts* ***with a 145-hp. six, ends with a 280-hp. V-8. Javelin will compete with Mustang, Camaro, and Barracuda, and stands out for important refinements not available in the others: bucket seats with reclining backrests, flow-through ventilation (no vent windows in doors), and a preset impulse locking system on the doors.***

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PS PICKS 13 WINNERS

FORD TORINO *replaces Fairlane 500 XL in Ford's intermediate line. This model brings new luxury and elegance to medium-size cars. It's longer, wider than last year's Fairlane, with wider track front and rear. Front disk brakes are standard on all Fords with power brakes.*

PLYMOUTH SPORT FURY *is the hottest of 27 models in the Fury line, which showed the largest sales rise of any high-volume car in the '67 model year. For '68, the Fury retains stacked headlights while the grille has been redesigned to emphasize width (77.7 inches). Power plants range from a 225-cubic-inch six to the Super Commando 440. A new luxury option is Chrysler's Auto-Temp control system for air-conditioned cars.*

COUGAR *line from Lincoln-Mercury expands with this hot GT.E powered by a 427-cubic-inch V-8. The GT.E is distinguished from other Cougars by the two simulated air scoops on the hood, a two-tone paint job with argent lower-body color, and its quad exhaust pipes.*

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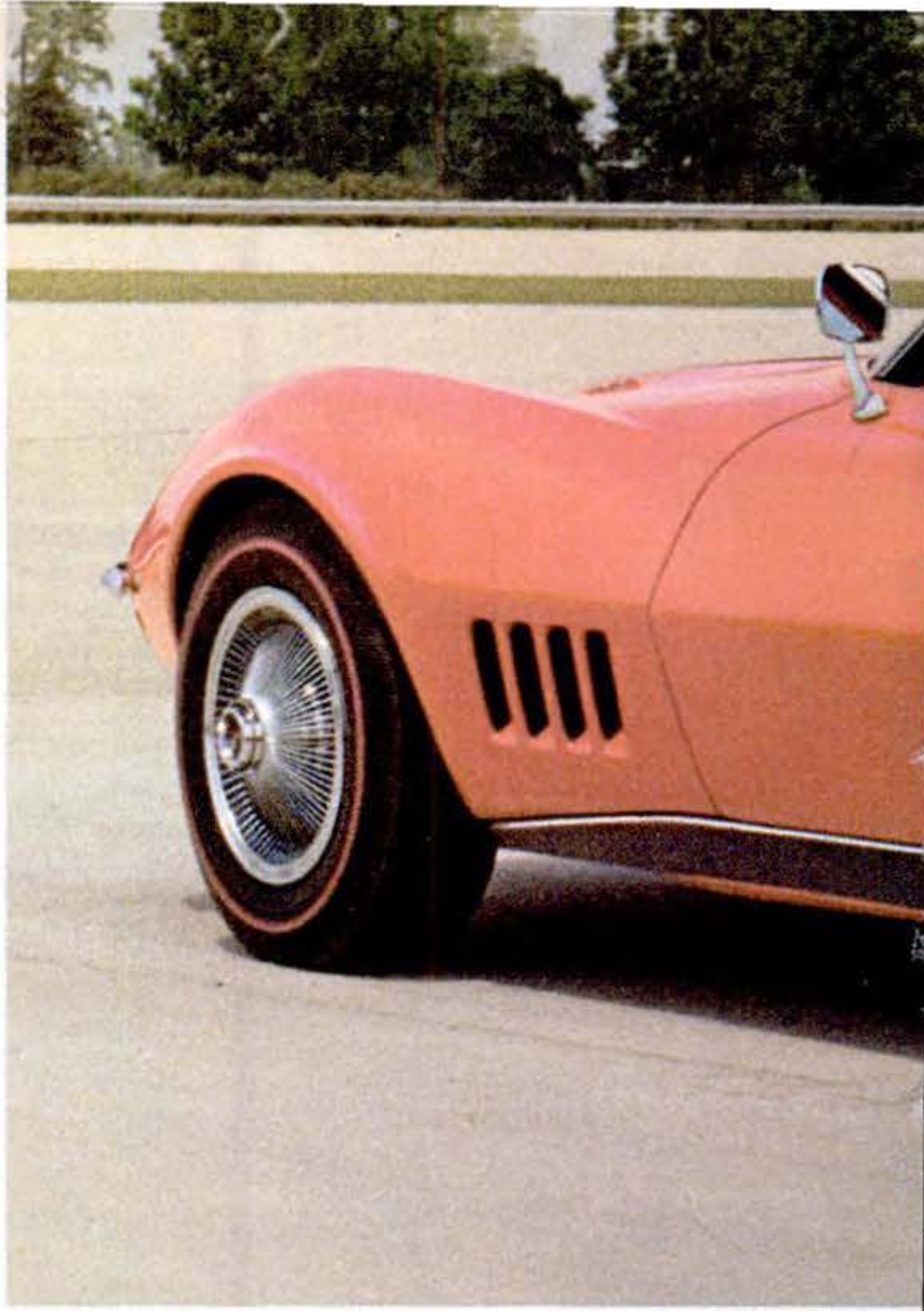
CHEVROLET CORVETTE *will follow the successful five-year run of the Sting Ray with a totally new car. The new Corvette is almost two inches lower and over seven inches longer. Power plants range from 300 to 435 hp. (all V-8s, of course). F70x15 wide-oval tires are standard. Suspension modifications include higher-rate (stiffer), progressive-action, front coil springs, and revised rear-end geometry with a lower roll center. The fiberglass body features new and more elaborate steel reinforcements shaped to form an actual roll cage around the passengers.*



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BUICK SPORTWAGON, *star of the '68 wagons, has longer wheelbase (116 inches), increased second-seat leg room, wider rear seat, increased front track, skylight windows, sweepline styling, optional wood-grain side treatment. Standard 350 cubic-inch V-8 comes with 230 or 285 hp., and a 400 cubic-inch V-8 coupled to a Turbo-HydraMatic transmission is optional, too. Modified rear-axle suspension geometry, firmer shock control, stiffer front springs, and beefed-up stabilizer bar give quicker handling, flatter cornering, and pleasant but firm ride.*

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PS PICKS 13 WINNERS

OLDSMOBILE TORONADO *gets a facelift for '68, along with important engineering modifications. It continues to champion front-wheel drive, of course. The engine is enlarged from 425 to 455 cubic inches, and standard final drive ratio is lowered from 3.21 to 3.07. These changes*

PLYMOUTH GTX *is the supercar in Plymouth's intermediate line, which also includes Belvedere, Satellite, Sports Satellite, and Road Runner. The GTX has only two body styles: two-door hardtop or convertible. Both are distinguished by the tough-looking front with its deep-set grille and the dual outboard-facing air scoops.*

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reduce noise levels inside the car and improve fuel economy. A new tandem booster for the power brakes gives increased braking effectiveness. Toronado '67 sales volume fell to one-third of '66 production, but new model should send sales up again.

DODGE CHARGER *is a totally new car for '68. It's now a six-passenger automobile, and it's not a fastback. There's only one Charger body: the two-door hardtop. Mechanically, it is a Coronet. Power plants range from a 318-cubic-inch V-8 to the Hemi-Charger 426 (no sixes). A high-spring-rate, rally-type suspension is standard.*

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OLDSMOBILE CUTLASS S

This squat, sleek, two-door hardtop is the essence of the new breed of sporty intermediates. The Cutlass line offers 12 engine-drive-train combinations, the top power option being a 310-hp. version of the 350 cubic-inch Olds V-8. It is available with Jetaway two-speed automatic transmission and a 2.56:1 final drive ratio, which cuts noise and vibration, improves gas mileage and limits exhaust emissions. Rear-suspension modifications improve the car's understeer characteristics while allowing spring changes to give a softer ride.

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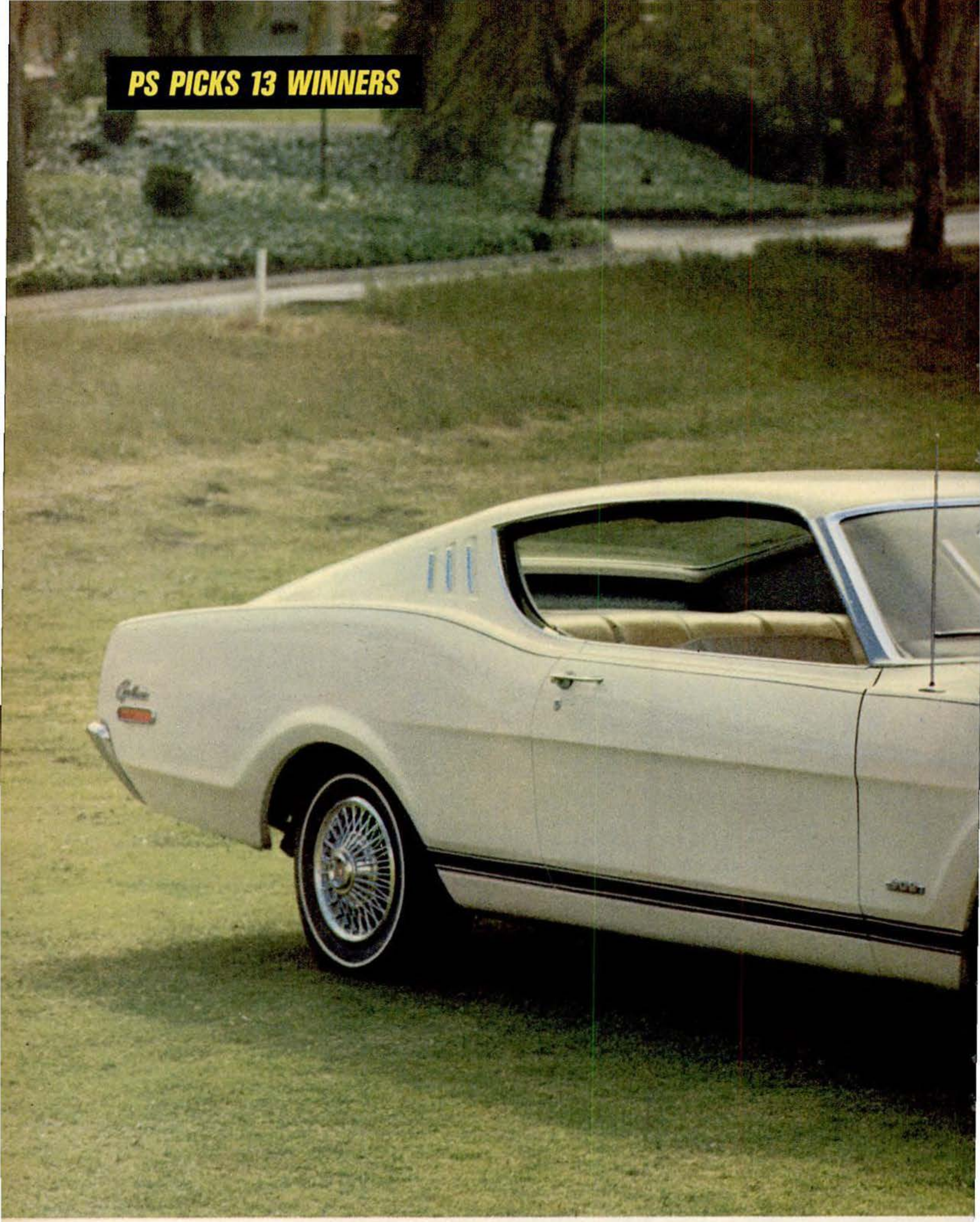

MERCURY CYCLONE GT *is a true fastback coupe built on a 116-inch wheelbase. Unit body stands less than 4½ feet high, and proportions of the car are underlined by the horizontal-theme full-width grille and the absence of vent windows in the doors. Everything about the Cyclone's*

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styling stresses its relationship with the full-size Mercury. Mechanically, the Cyclone is a Montego (Comet is no longer a line, but just the base model in the Montego class). Power options include both the Marauder 390 and the Cyclone 427 V-8 engines.

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PS PICKS 13 WINNERS

PONTIAC GTO *is the original supercar, and the '68 model will no doubt set new standards in the field. It keeps up appearances. But it does more than that. Track has been widened to 60 inches front and rear. Both the 350-hp. standard V-8 and the 360-hp. HO option are available with Turbo-HydraMatic 3-speed transmission. Rubber front bumper, hood tach, and concealed headlights complete the image.*

DODGE DART GT *shook up the competition in 1967 and the new model goes to new heights with a high-winding 340-cubic-inch V-8 and axle ratios down to 2.76:1. The bumblebee stripe on the rear fenders gives unmistakable identification for those who miss the air vents on the hood. With a 383-cubic-inch performance option, the Dart GT is the muscle-leader among 14 new Dart models.*

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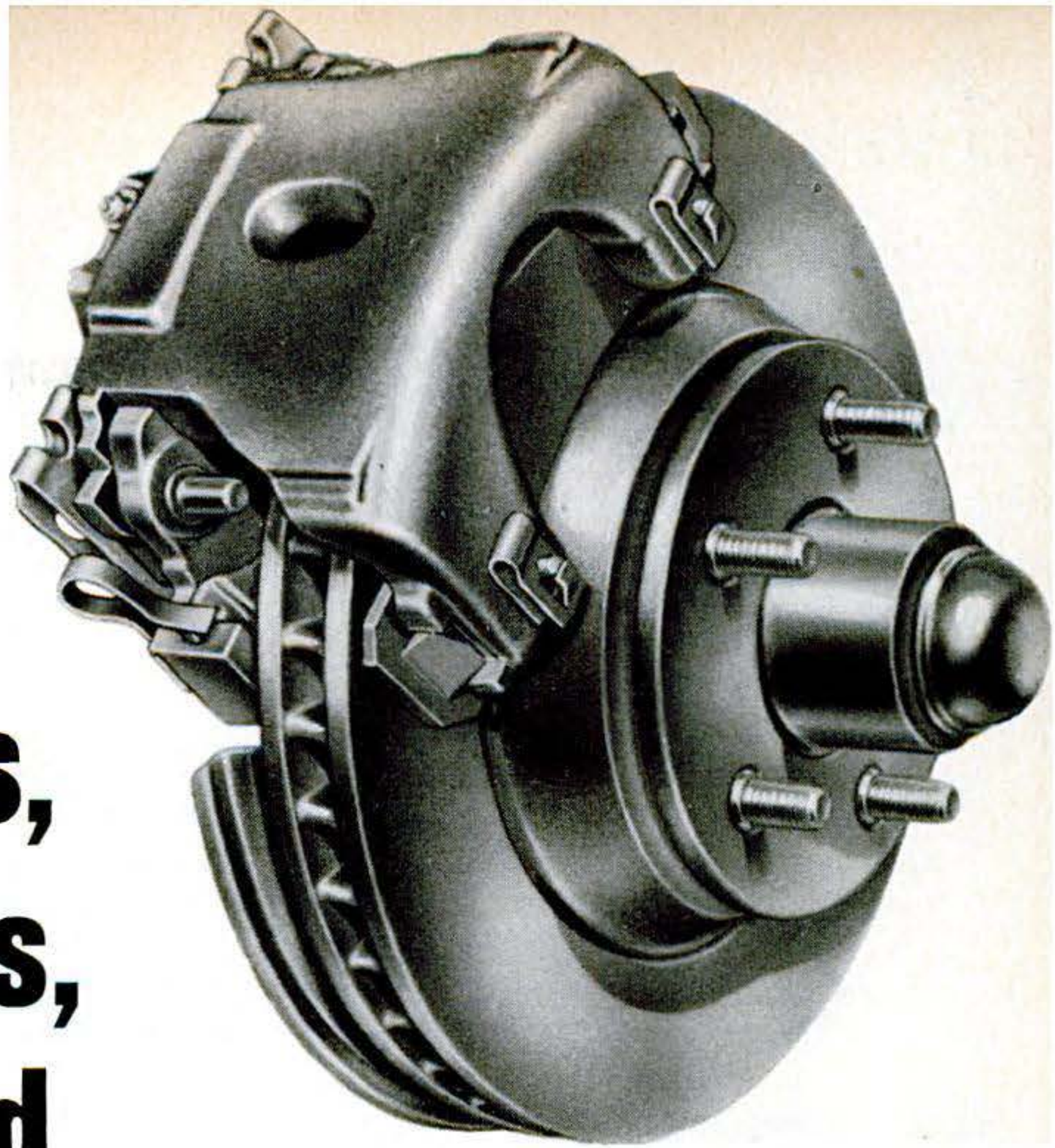
INSIDE THE '68s:

New Brakes, Suspensions, Engines, and Body Details



Ford's new floating-caliper disk brake, shown above, has only one piston (compared with four pistons in last year's model). The wheel cylinder is located inboard of the disk, and the caliper has freedom to float sideways. Brake pressure is equalized between the inside and the outside pads. This new Ford brake offers improved cooling, simplified (and less costly) construction, reduced fluid displacement, and greater ease of maintenance.

Ford standardizes front disks on all cars with power brakes; Cadillac, Chrysler, and Ford offer three completely new engines; all auto makers show many body and chassis improvements

By JAN P. NORBYE / *PS Automotive Editor* **and JIM DUNNE** / *PS Detroit Editor*

Auto engineering is definitely safety-oriented this year. All the new cars meet the federal standards [PS, June '67] for accident avoidance, occupant protection, and emission control. Designing and developing the necessary hardware forced shelving of some pet projects. Ford's long-awaited new engine family is only one engine right now. Oldsmobile's overhead-cam V-8 has been put aside. So has Pontiac's. Development of the AC electric fuel pump (immersed inside the tank) has been slow, but the unit will probably appear throughout the Buick line sometime during the year.

In some safety areas, the industry has gone beyond minimum legal requirements. The most outstanding development: Ford's decision to put front disks on all cars with power brakes, indicating that the day of disk brakes as standard for all cars is coming fast. True antiskid devices are still not ready, but they're coming—the next milestone in safety. Side-marker lights and rear-window defoggers, not required for another year, are available on most cars right now. There has been substantial improvement in exhaust-emission control systems, too.

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What's New at Ford

Ford Motor Company's big news is in the intermediate lines (Mercury Comet, Montego, Cyclone; Ford Fairlane and Torino). These cars have brand-new unit bodies. All the hardtops have ventless glass in the doors and flow-through ventilation. The new fastbacks have tinted glass in the rear windows to keep interiors cooler in hot weather and reduce glare.

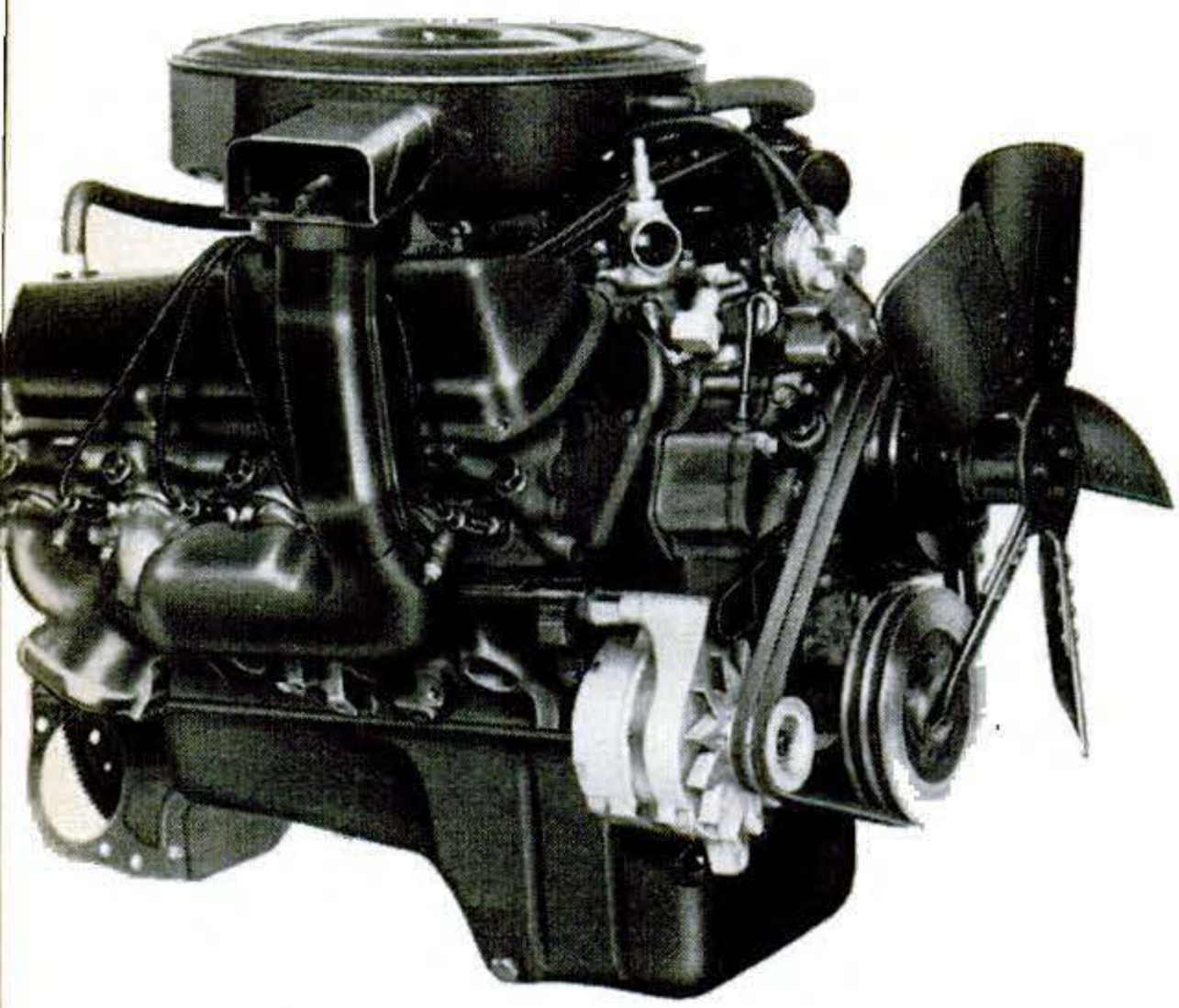
Ford's one all-new engine, the 429 V-8, is described in the caption below. In addition, the base V-8 is available in an enlarged—302-cu.-in.—version. It's really the 289 V-8 with a longer stroke, and new crankshaft, connecting rods, and pistons.

Going beyond the minimum legal safety requirements, Ford's cars have four safety changes that are of special interest:

- A new impact-absorbing steering column. The flowerpot steering-wheel hub is now a thing of the past.
- An inside day/night, foldaway, rear-view mirror mounted in a ball socket attached to the windshield.
- Extra-strength laminated safety glass in all windshields. The new glass will take a higher impact force without breaking.
- Ashtrays removed from all armrests.

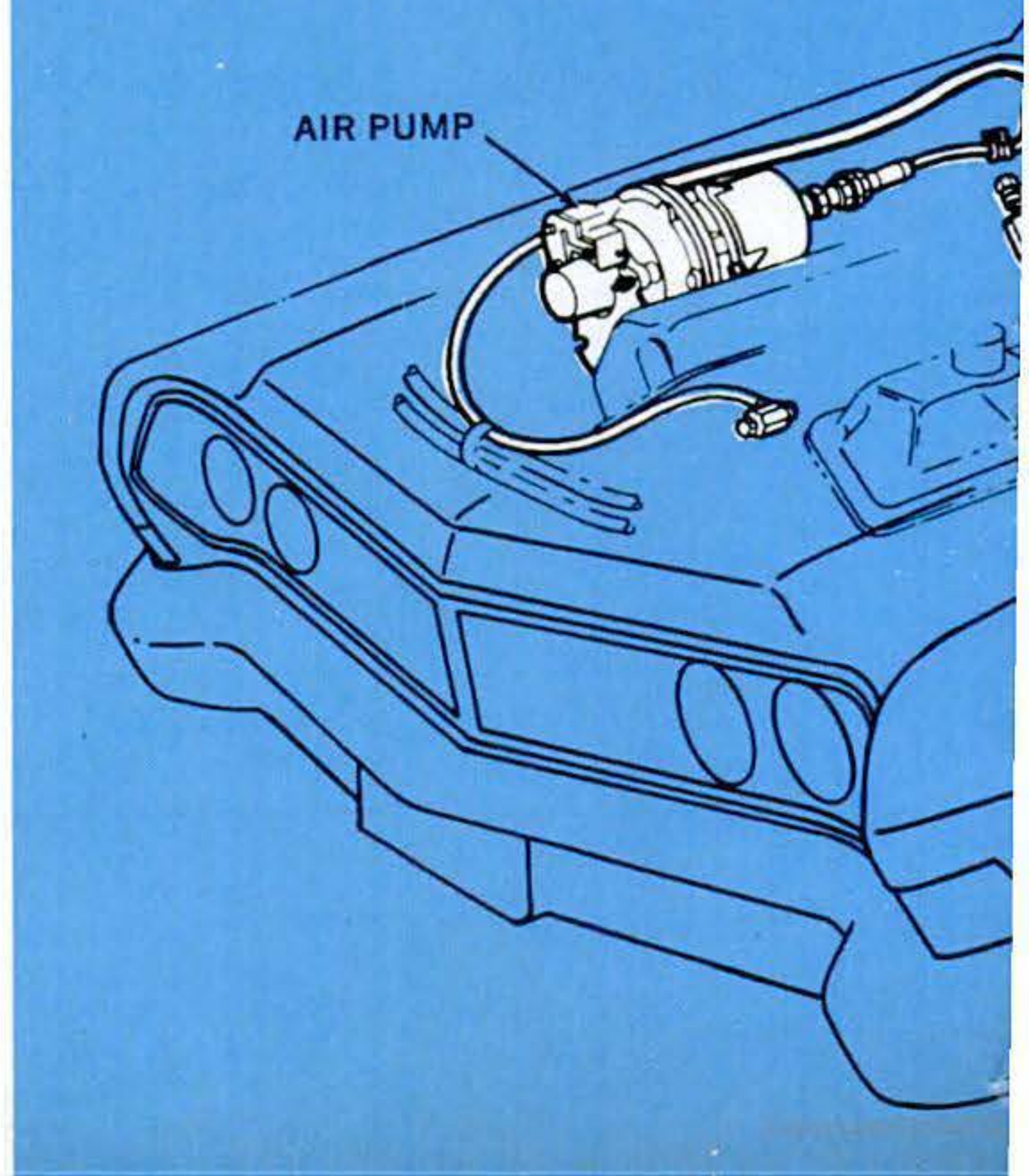
Ford has two exhaust-emission control systems—Thermactor and IMCO.

Thermactor has a pump that injects fresh air into the exhaust ports, adding oxygen to unburned gases so they will burn. The Thermactor system does not improve engine efficiency but merely re-



Thunderbird's new engine is a 429-cubic-inch V-8 with 4.36-inch bore and 3.59-inch stroke. It's a lightweight cast-iron unit based on the same design and manufacturing principles as the highly successful 289 V-8. Wedge-shaped combustion chambers were developed to combat exhaust emissions, using canted valves that open obliquely into the combustion chambers in the direction of the gas flow. The crankshaft is a hefty five-bearing cast-iron job with a three-inch main-bearing diameter and 2.5-inch crankpins. The block ends at the crankshaft centerline, in contrast to the Y-block 390-, 427-, and 428-cubic-inch engines. Slipper-skirt pistons carry one oil-control ring and two compression rings. The top ring is moly-filled. Intake and exhaust valves have flash-chromed stems and tips. Compression ratio is 10.5:1 and horsepower is 360 at 4,600 r.p.m. Max torque is 480 lb./ft. at 2,800 r.p.m.

Ford's automatic load leveler is now a regular factory-installed option for the entire Ford line (not just station wagons). It keeps the car level regardless of load, giving maximum ride comfort and improved controllability. It keeps the headlights aimed at the road at all times as well. The sketch shows how it works. An air cylinder is contained within each coil spring at the rear



duces the noxious exhaust emissions.

IMCO, on the other hand, assures improved combustion, i.e. better utilization of the fuel. There is no additional hardware—the system involves modifications in combustion chambers, camshaft, intake and exhaust manifolds, plus changes in carburetors and distributors. The idle-mixture screws carry plastic limiters that restrict richness adjustment.

IMCO is used on all 1968 Ford engines teamed with automatic transmissions, except the high-performance 289 V-8 in the Mustang; the four-barrel 390 in the Mustang, Fairlane, Cougar, Montego, and Cyclone; and the four-barrel 427 in the Mustang, Cougar, Comet, Montego, Cyclone, Fairlane, Ford, and Mercury.

Thermactor is used on all Ford engines teamed with manual transmissions, plus the exceptions noted above.

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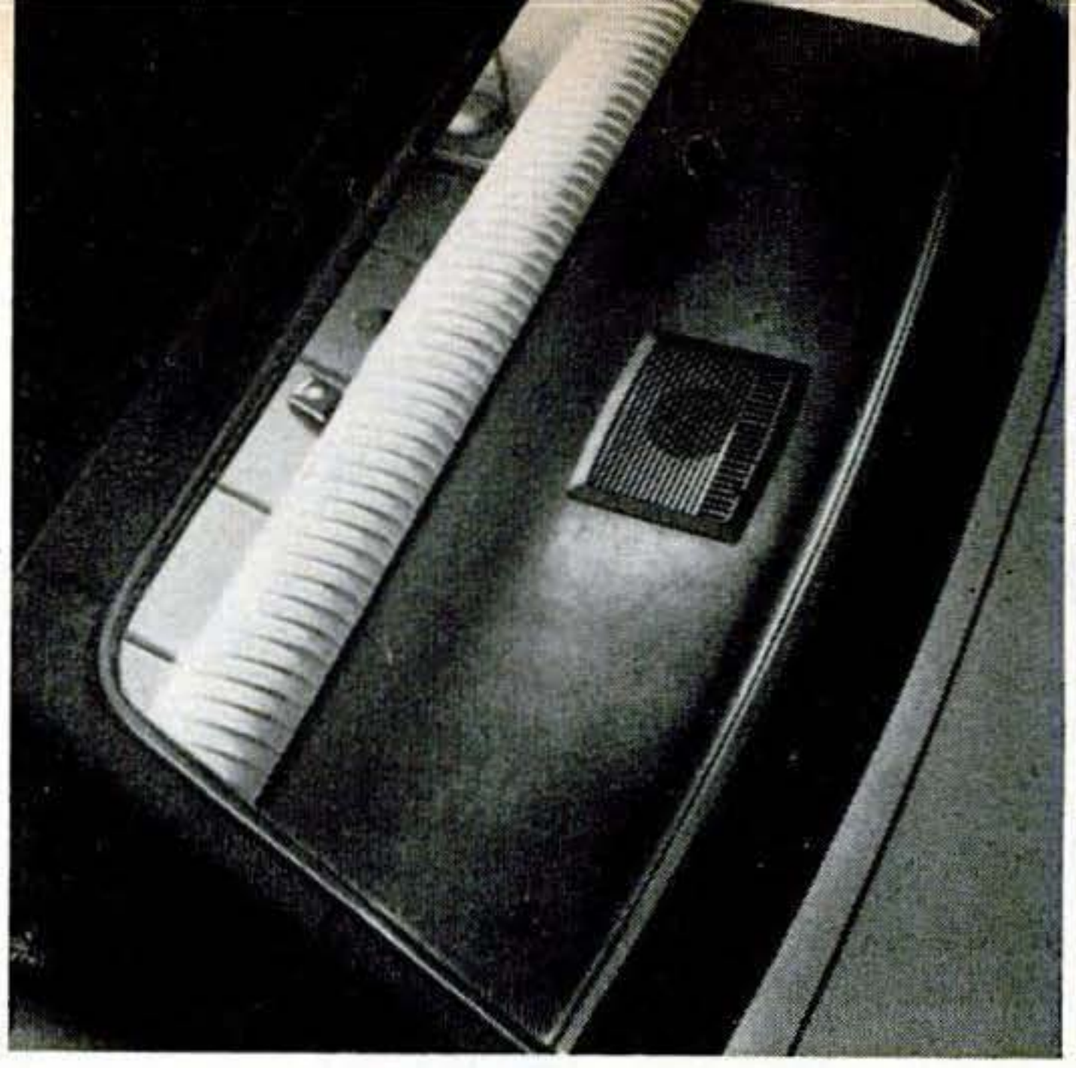
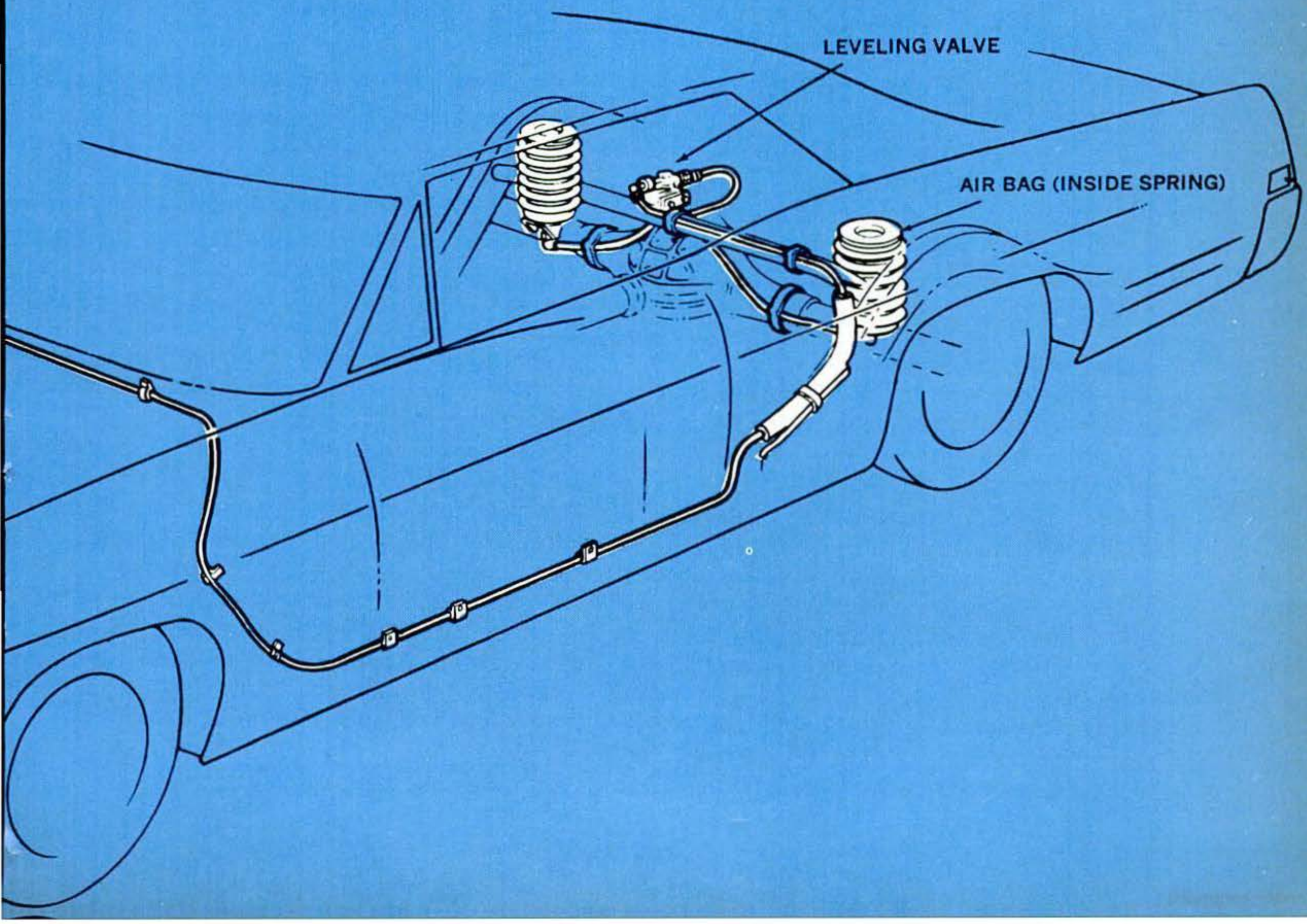
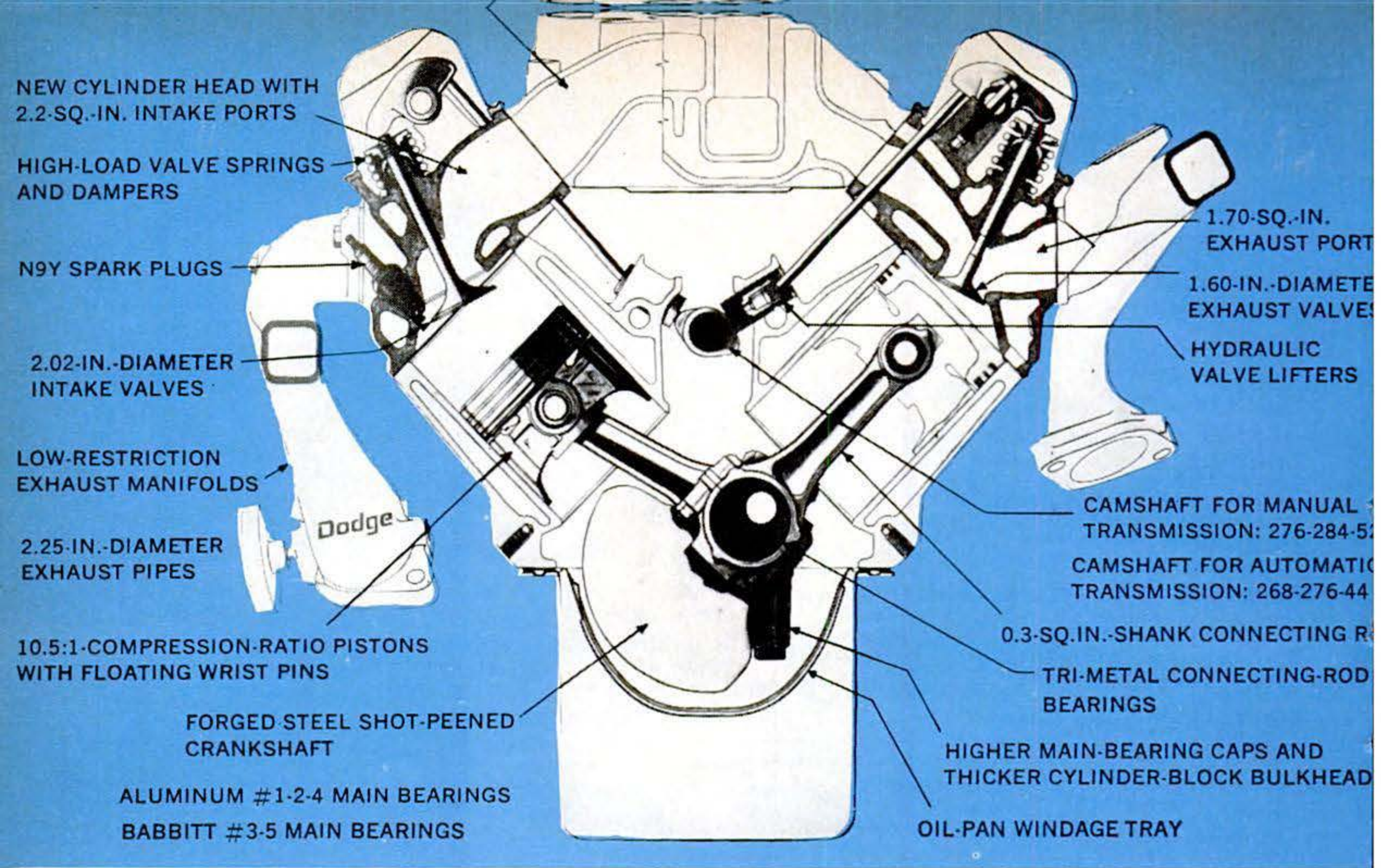


Ford's rear-window defogger distributes a stream of air across the inner surface of the glass to keep the pane clear. This is a less expensive option than a full de-icer (a Chrysler specialty with separate heater element). Similar defoggers are available for all '68 cars except American Motors'.

to maintain constant height. Air pressure is provided by a pump mounted on the engine and driven by vacuum from the intake manifold. A reservoir is located next to the pump. The reservoir feeds air to a leveling valve that controls pressure in the cylinders. Air pressure goes up when the load is increased and goes down when the load is reduced. The leveling valve incorporates a time-delay switch to prevent operation of the system during load changes caused by normal spring motion due to road unevenness. The pressurized air travels in wear- and chemical-resistant nylon tubing, and enters the cylinders at the bottom end, avoiding friction with or pinching by the spring coils. The entire system is fully automatic and requires no periodic maintenance to keep it working.





Chrysler Corp.'s new 340 V-8 is optional for the Dart and the Barracuda. A high-performance unit, it puts out 275 horsepower at 5,000 r.p.m. The carburetor is a four-barrel Carter AVS with a low-restriction nonsilenced air cleaner. The ignition distributor has a dual breaker, and the camshaft is driven by a double-row roller chain. Camshaft figures on the drawing above indicate valve-opening duration, intake, and exhaust, and valve overlap (both valves open) in degrees of crankshaft rotation.

What's New at Chrysler

Chrysler is planning to make hay with fully restyled intermediates for both Dodge and Plymouth. Like all Chrysler Corp. cars, the new models have unit-construction bodies (integral with frame). But the important engineering news lies in the power units. And the engine story doesn't end with the new 340 V-8 above. Three other Chrysler engines have been improved:

- The 273 V-8 now has hydraulic valve lifters, instead of mechanical lifters, for smoother and quieter operation and reduced maintenance.
- The 383 V-8 now has cylinder heads and intake manifolds from the 440. This change gives better breathing and a gain of about five horsepower.
- The 440 V-8 has larger-diameter exhaust valves and reworked combustion chambers to improve high-speed performance while reducing exhaust emissions.

Chrysler engines with four-barrel carburetors have the new Carter AVS (Air Valve Secondary), which gives more-positive action in opening the secondary barrels when full power is needed. An air valve opens the secondary barrels on demand from the engine. On older four-barrel carbs, the secondaries are opened according to the position of the throttle linkage. The Carter AVS is said to be more economical (saving gas when full power is not needed) and to improve performance (giving full power quicker when conditions call for it).

All Chrysler Corp. engines use the Cleaner Air Package [PS, Mar. '66]. The system is unchanged, but engine modifications, tailored for more-complete combustion, reduce harmful emissions.

Like Ford, Chrysler has an active safety-research program independent of legal requirements, and has originated several new safety features:

- An energy-absorbing upper seat back.
- Padded, snap-off ashtrays.

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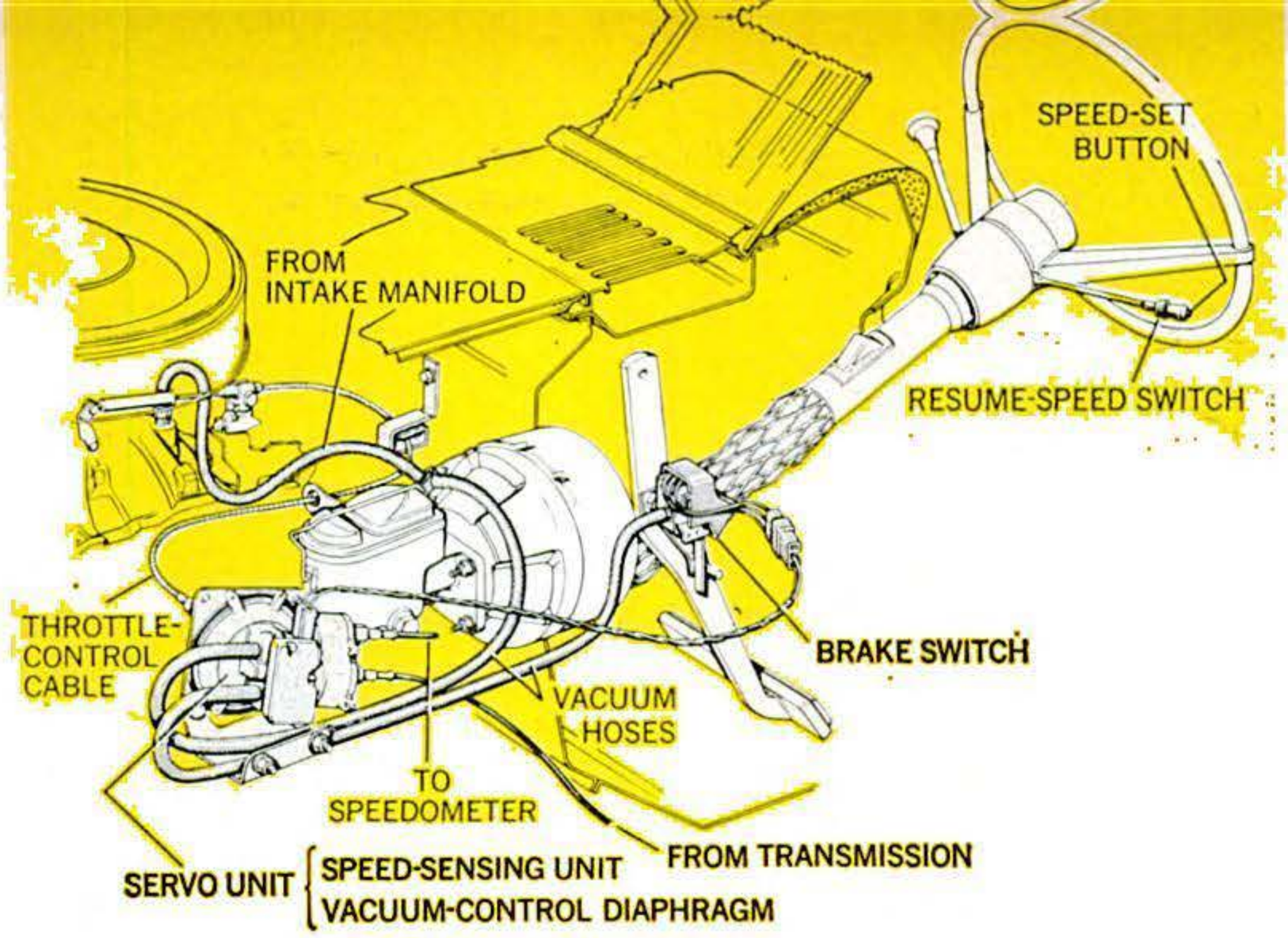
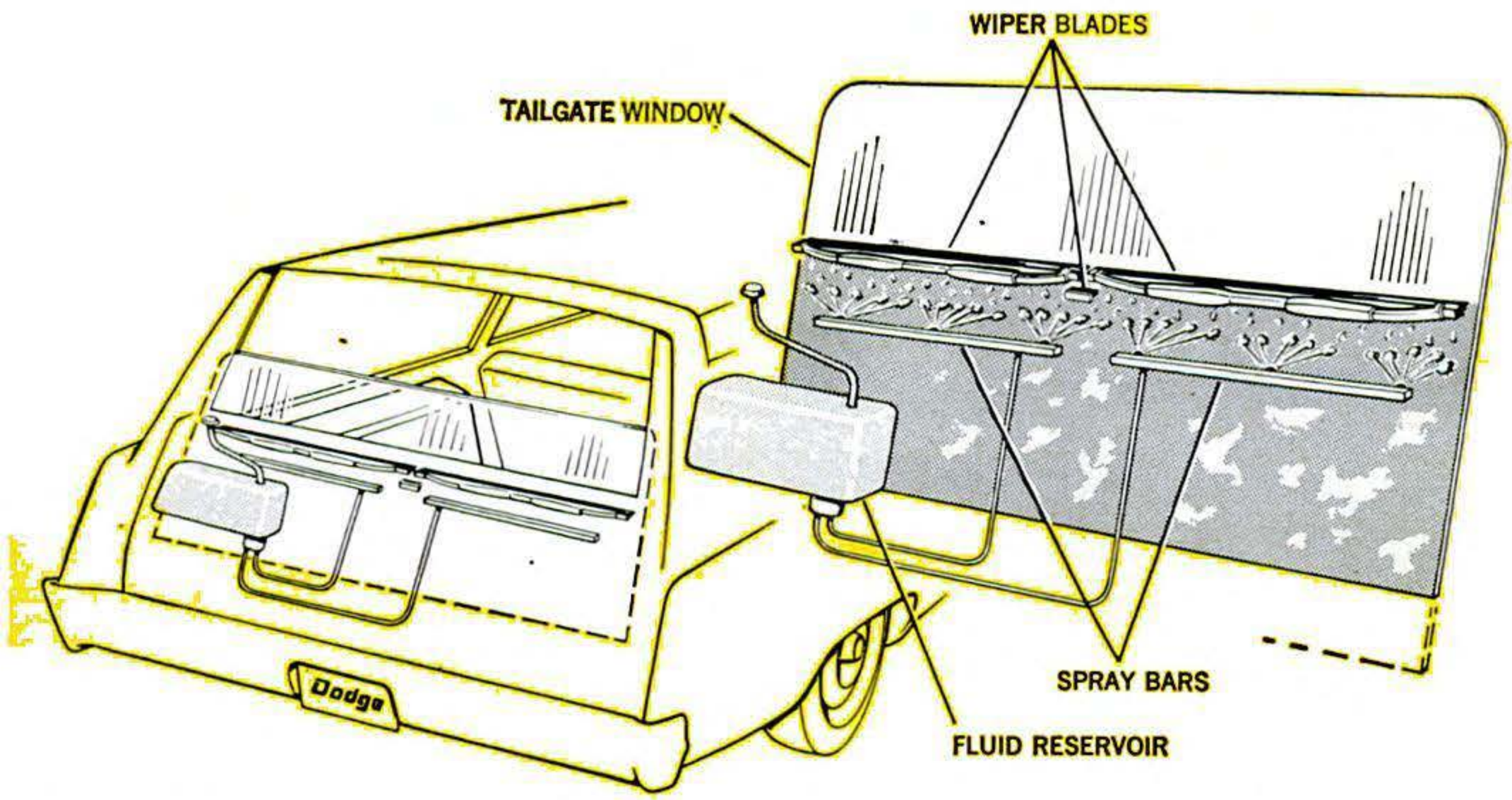


New speed-control system is available for the Imperial, Chrysler, Plymouth, and Dodge intermediate and full-size models. Push in speed-set button at end of turn-indicator stalk to engage the system. When you apply the brakes, a switch opens the vacuum hose to the atmosphere and disengages the speed-control unit. To resume speed, twist the knob on the stalk. Like GM and Ford systems, a speed transducer in the speedometer generates electric signals proportional to true road speed and the desired cruising speed.

- Window knobs of rubber that flatten on impact.
- Rear-window wiper on wagons.

Novelties you'll find in body construction include a wiper/washer system for the tailgate window (shown below) that's standard on all wagons, and a new two-way tailgate for the Plymouth Belvedere and Dodge Coronet.

Chrysler's double-hinged tailgate differs from the Ford/Mercury design in having a single release handle. It is cupped within a depression of the tailgate ledge near the inside right-hand corner. (Ford's two-way tailgate has a separate outside handle for opening the tailgate like a door.) The Chrysler handle lowers the tailgate to make a flat bed when pushed one way; opens it like a door when pushed the other way. Belvedere and Coronet wagons are available with a choice of two or three seats just like the larger Plymouth Fury and Dodge Polara and Monaco series.



All wagons of the Chrysler Corp. come with a concealed wiper and washer system for the rear window. Horizontal squeegee wipers inside the tailgate wipe the window whenever it is raised from a fully lowered position. The wipers work in conjunction with an electric washer system that sprays fluid on the glass when actuated by a pushbutton on the instrument panel. The fluid reservoir is built into the tailgate. A special filler cap is fitted in the upper left hand corner of the tailgate.

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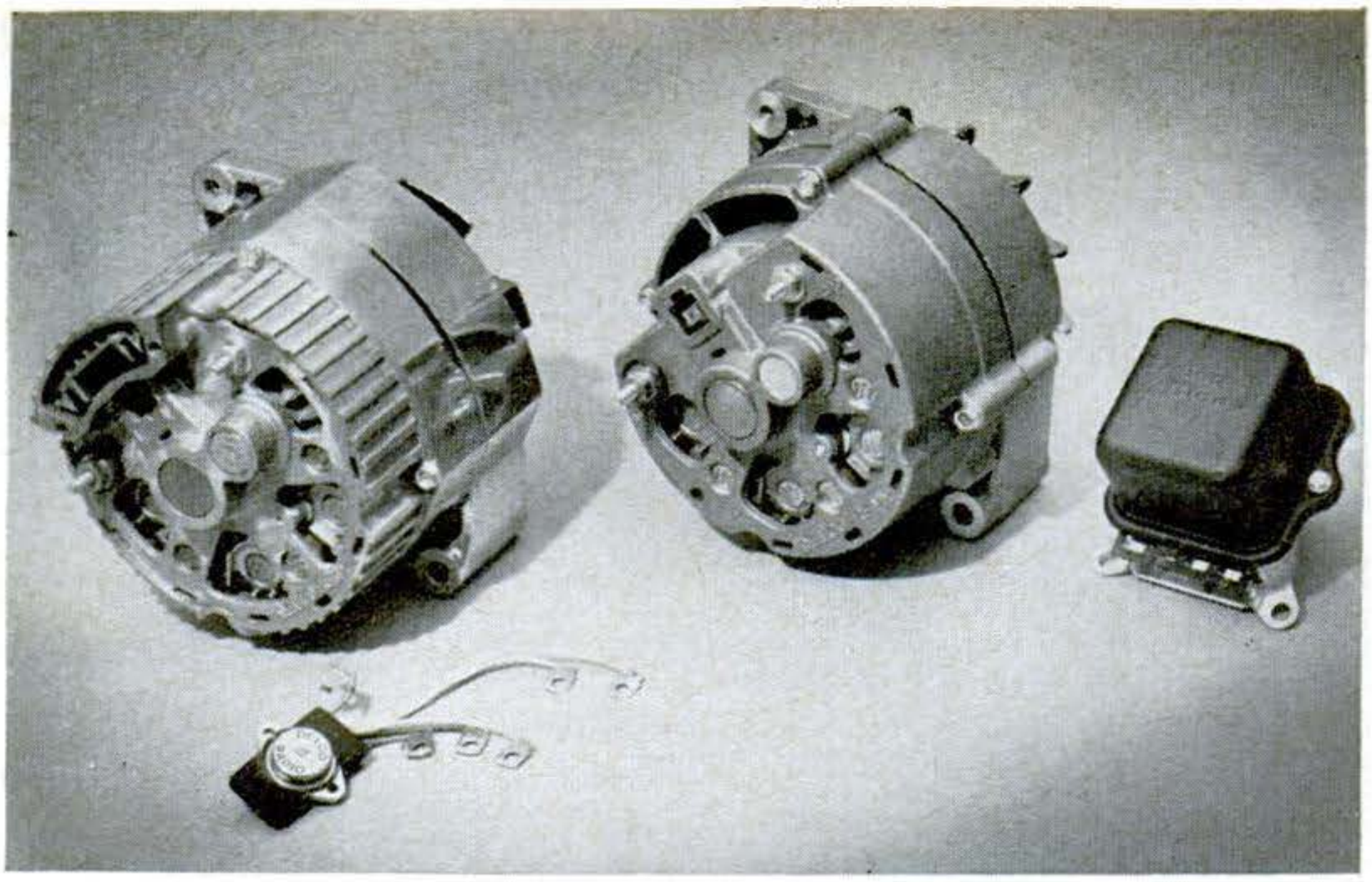


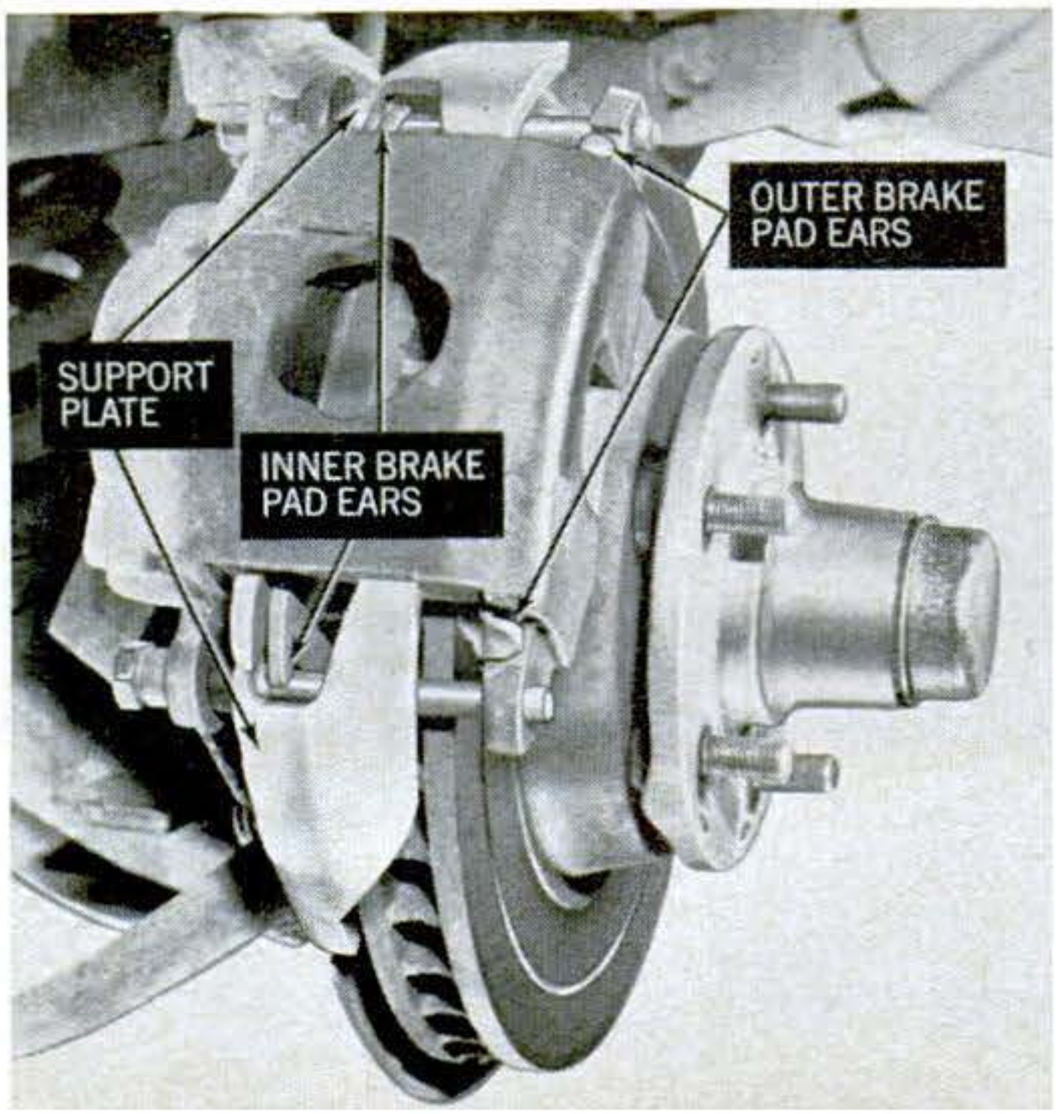
Pontiac has a revolutionary charging system, which uses integrated microcircuits. The alternator has been combined with the voltage regulator in one compact unit (left) called an integrated circuit regulator. Old alternator and separate regulator are shown at its right. Integrated circuit regulator will be standard on '68 Grand Prix, optional on all Catalina, Executive, and Bonneville models. Pontiac developed the integrated circuit regulator in cooperation with Delco Radio and Delco-Remy divisions of GM.

What's New at General Motors

All GM car divisions have rejuvenated the intermediates for '68 by giving all two-door cars a shorter wheelbase than the four-door models. A closer look at the entire lineup from Chevrolet, Pontiac, Oldsmobile, Buick, and Cadillac also shows a multitude of new ideas in engineering. The best ones are illustrated here.

Most GM cars use the controlled-combustion system of exhaust emission control, preheating carburetor intake air to a constant 100 degrees F. [PS, May]. The others continue with the air-injection reactor [PS, Mar. '66]. All GM cars have an antitheft feature—a buzzer that sounds if the key is still in the car when you open the door.

Cadillac is not standardizing disk brakes but introduces this single-piston floating-caliper front-wheel disk brake as an option for all models except Eldorado (which continues with four-piston caliper).



Each GM car division has its own technical novelties for '68. One trend shared by all, however, is increased engine displacement and lower numerical axle ratios, which means quieter, slower-revving engines and more economical cars.

Changes in transmission units also affect all car divisions. The Turbo-Hydra-Matic design has been simplified. The switch-the-pitch stator member in the hydraulic torque converter has been replaced by a fixed stator (as in Chrysler's TorqueFlite, Ford's Cruise-O-Matic).

The revised GM transmission allows automatic part-throttle downshifts, runs cooler under heavy throttle conditions, promises improved reliability and life.

Here's the news in a nutshell, by make.

Chevrolet

The 283 V-8 has been replaced by a 307 as the standard power unit for Chevrolet, Chevelle, and Chevy II.

A new-size Chevy II is based on the Camaro underbody.

Chevy II wagon is discontinued (replaced by the new low-line Chevelle wagon).

Front brake drums on Chevelles will be finned.

Pontiac

Rubber bumper for the GTO.

Integrated alternator/voltage regulator.

Single-overhead-cam six enlarged from 230 to 250 cu. in.

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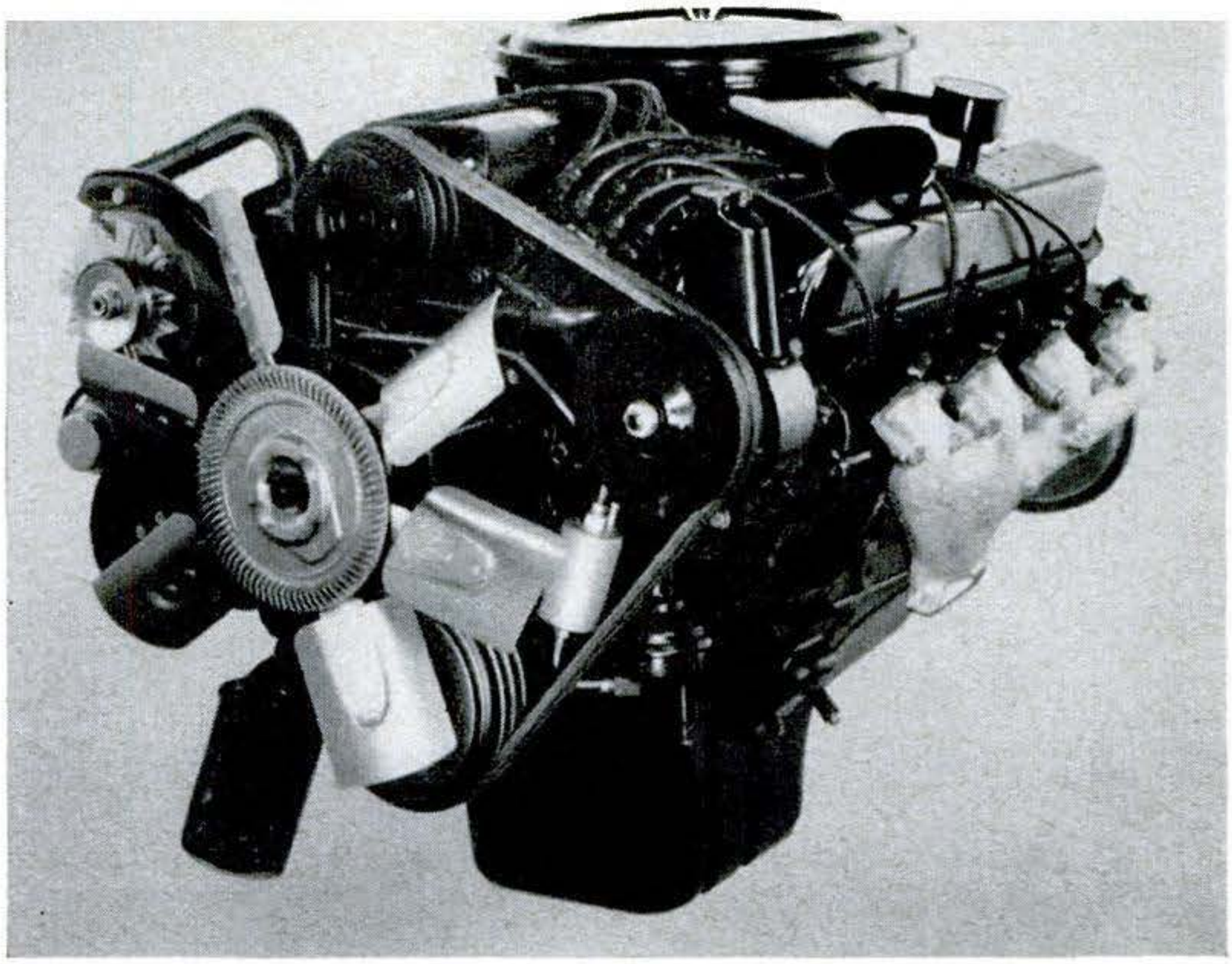
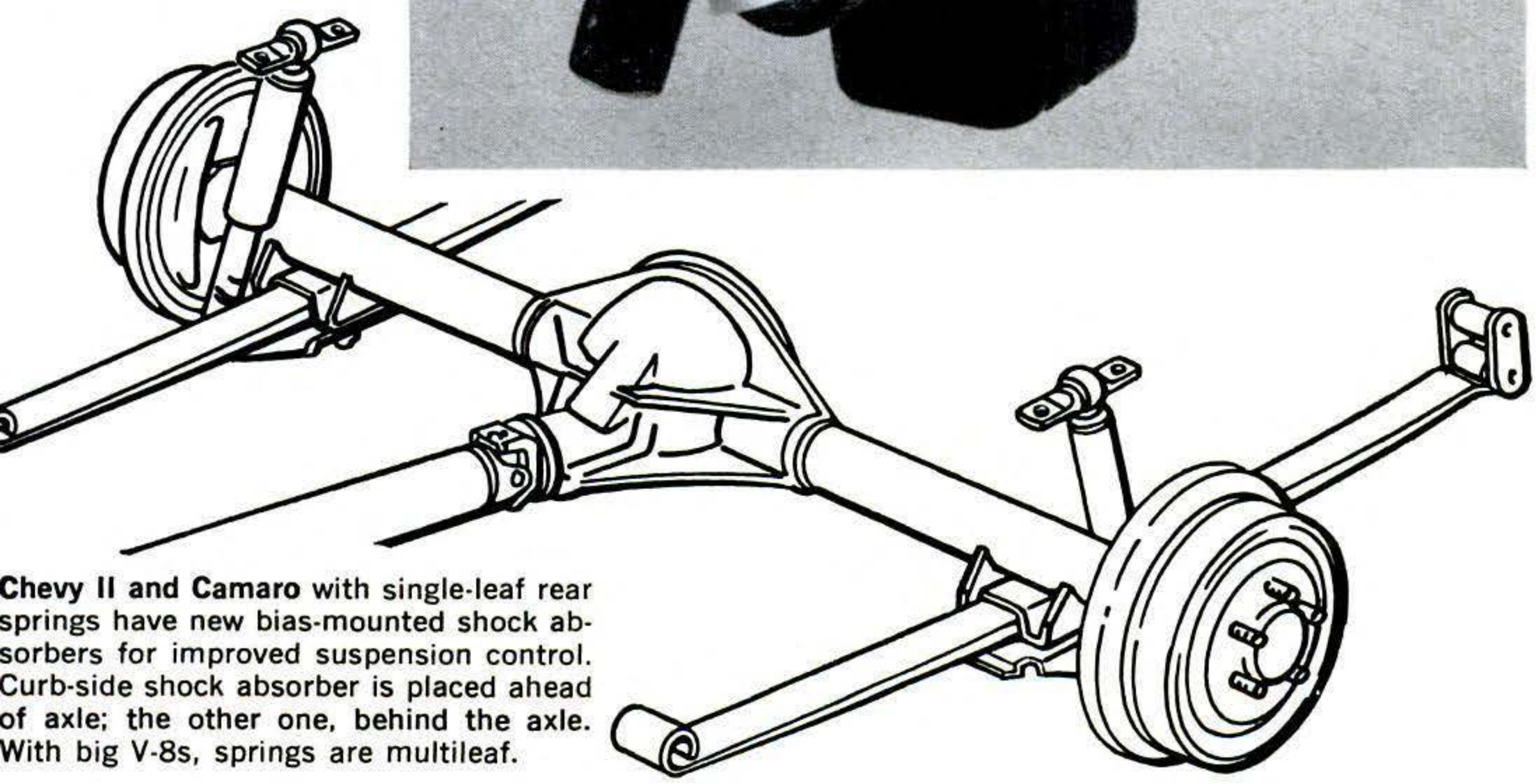
Cadillac's new V-8—the world's largest passenger-car production engine—has 472-cu.-in. displacement. Cylinder bore is 4.30 in.; stroke, 4.06 in. With 10.5:1 compression ratio, output is 375 hp. at 4,400 r.p.m. Maximum torque (525 lb./ft.) is developed at 3,000 r.p.m. Power unit is standard in all '68 Cadillacs, including front-wheel-drive Eldorado with 2.94:1 final drive ratio. New engine was developed to raise torque throughout the speed range while lowering stress levels, and to improve quietness and smoothness.





Chevy II and Camaro with single-leaf rear springs have new bias-mounted shock absorbers for improved suspension control. Curb-side shock absorber is placed ahead of axle; the other one, behind the axle. With big V-8s, springs are multileaf.

Asymmetrical multileaf rear springs for the Firebird instead of single-leaf.

Power-flex fan for 428-cu.in. HO-option engines (blades flex to reduce air flow and power loss at high r.p.m.).

Body-protection molding on doors.

Oldsmobile

Small V-8 increased in displacement from 330 to 350 cu. in.

Big V-8 enlarged from 425 to 455 cu. in.

Inner fenders (wheel wells) for full-size models are plastic, saving cost and weight, adding rust protection.

New tilt-and-telescope steering-wheel option with constant-contact horn ring. Squeeze the rim to blow the horn.

New tires and softer rear springs for the Toronado.

Convoluted fuel-tank filler neck that will bend and collapse under impact.

Buick

Small V-8 enlarged—340 to 350 cu. in.

Wick oiler added to distributor contact breaker to prevent rubbing block wear.

Lowered track bar in Riviera rear suspension to reduce rear-end understeer.

Cadillac

A giant-size 472 cu. in. V-8.

New single-piston disk-brake caliper.

New engine-temperature indicators, using a metallic temperature-sensing device in the engine block, with a light and a buzzer to warn of overheating.

Molded inner-door panels in all doors.

Power windows standardized, including Eldorado rear-quarter windows.

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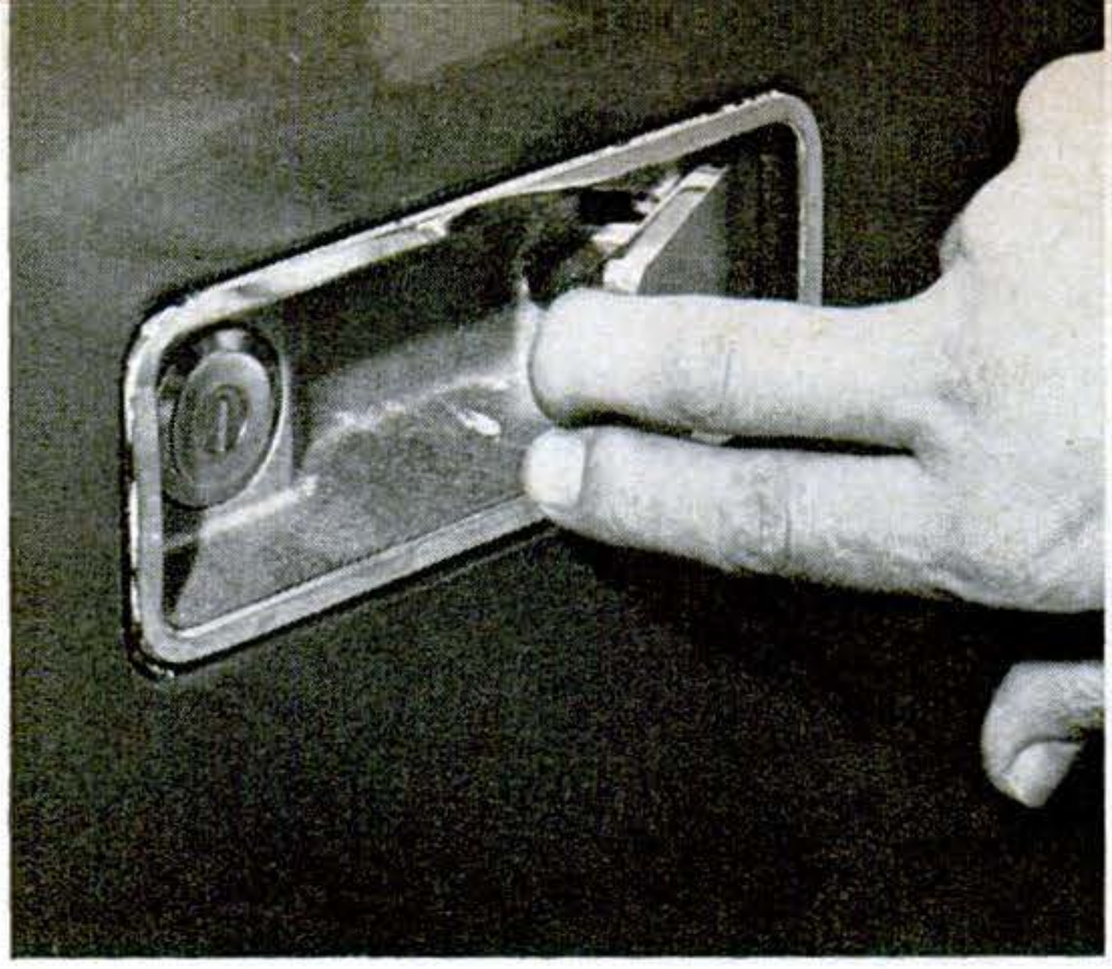

Outside door handles on the Ambassador, Rebel, and Javelin are set flush in the door panels. Paddle handles are spring-loaded and you pull to open.

Front door locks work on a preset impulse, need one hand only. This handy switch is recessed in the door armrest, replaces pushbuttons on door sill.

What's New at American Motors

Not content with creating a sensation with its new Javelin [page 99] American Motors has other exciting projects coming up, too. But the bread-and-butter Ramblers have only minor modifications for the coming year.

Changes in the Rambler line are primarily to consolidate the American's position as a compact car at a subcompact price. The Rogue convertible, 220 wagon, and 440 two-door sedans and hardtops are gone. The simplified lineup has two- and four-door sedans in the 220 series, a four-door sedan and wagon in the 440 series, and a Rogue two-door hardtop.

The policy of avoiding styling changes in the American means a cut in retooling costs, with expected savings passed on to the customer as a price cut (effective since last February 22).

Nevertheless, the two- and four-door sedans have a lower, sleeker roof line, and all Americans sport a new extruded aluminum grille with all-black finish, and full-length side moldings for better body protection and improved appearance.

The American does not have the smoothly contoured outside door handles or the front-door preset-impulse lock system standardized on the larger AMC cars.

The standard engine in the new Rogue is a special economy version of the sturdy 232-cu.-in. six, with water-heated intake manifold, specially calibrated carburetor, advanced ignition timing, 205-degree thermostat, recalibrated automatic-transmission control valves and governor. With this engine and automatic transmission (now called Shift Command throughout), the axle ratio is an ultra-low 2.37:1, reducing engine noise and vibration and improving fuel economy.

Both the 290- and 343-cu.-in. V-8 engines continue as power options for the American. The 343's cylinder heads are revised to give a greater volume of intake gas, and the intake valves are larger.

In the Rebel series, the 550 two-door sedan becomes a 550 two-door hardtop, and a 550 two-door convertible is added. There are no changes in the 770 and SST range. Two noteworthy mechanical modifications: The manual three-speed transmission (column shift) now has synchromesh on first gear. Front and rear coil springs are revised to increase ground clearance by ⅜ inch (except on wagons).

The Rebel and Ambassador wear a new injection-molded ABS plastic grille and separate nylon headlight housings. Front-wheel alignment is made easier on both Rebel and Ambassador, and AMC claims settings can be made with greater accuracy. Camber adjustment is moved from the upper control arm to the lower control arm, and caster adjustment is moved from the upper control arm to the drag strut.

The Ambassador DPL convertible is discontinued; a DPL four-door sedan is added. All DPLs come with V-8 engines.

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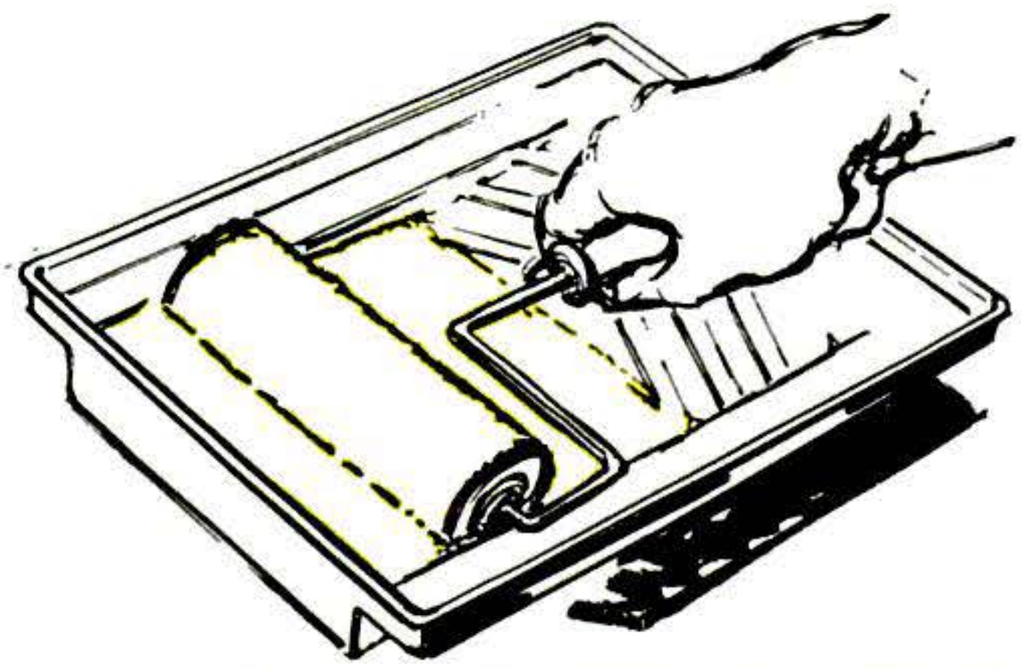
I'd like to see them make..."

DRAWINGS BY DANA RASMUSSEN

Pay-as-you-leave meters for off-street parking. A rising bar would lock in a car's wheels, lower when you paid off the meter.—*M. Davis, Aumsville, Ore.*

Outlets on car batteries so campers could run a shaver or trouble lamp. You could take the battery into a tent, too, as a power source for overnight use.—*J. A. Cook Jr., Baltimore.*



Paint-roller pans with a wide lip at the side to accommodate the handle extension. You'd need less paint—and waste less, too.—*Steve Kocian, Parma Heights, Ohio.*

Self-braking shopping carts that can't roll unattended. To push them, you'd press together the two-bar handle, releasing the brake.—*Arthur Hoglund, St. Louis, Mo.*

S.O.S. buttons on roadside telephones so you could reach the operator, if without change, to get help or make a reverse-charge call.—*Roy Russell, Macedonia, Iowa.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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PS VIEWPOINT

THE GREAT UFO PROBE

Can we trust the upcoming Condon Report?

By HERBERT SHULDINER

Dr. Edward U. Condon

The Air Force has delegated that hot potato —investigating reports of Unidentified Flying Objects—to the scientists. Will the riddle of flying saucers now be solved?

After 20 years of swirling controversy, science is taking its most searching look into the mystery of UFOs.

The intensive probe is headed by Dr. Edward U. Condon, former head of the National Bureau of Standards and currently professor of physics at the University of Colorado. He is aided by up to 30 top scientists from every field that might figure in the study of flying saucers.

Condon was handed this hot potato by the Air Force, which has failed to satisfy many thousands of believers with its explanations of saucer sightings. They've given him about $500,000 through the University of Colorado to make an objective study that, it is hoped, will satisfy believers and skeptics alike.

Can the Condon study finally solve the riddle of flying saucers, which has persistently eluded military investigators? Is it an attempt by the Air Force to whitewash the subject?

POPULAR SCIENCE took a close look at the work of the Condon team to bring you this progress report on the great UFO probe as the first year of the investigation is completed.

Condon entered the scene with the detached objectivity of an outsider with no special knowledge of saucers. His reputation as a tough-minded scientist was firmly established when he headed the National Bureau of Standards from 1945 to 1951. Condon reorganized the Bureau, modernized its operations, and moved its scientific functions out of the political arena, resisting Congressional pressures for such things as the approval of essentially worthless products.

An open mind. Condon's attitude toward UFOs when he started the probe was: "I'm an agnostic. I simply don't know." But he believed there was a need to find out whether there is a physical reality to saucers, and, if so, their origin. The study is open to any possibility, and the theory that UFOs are extraterrestrial in origin has not been excluded from consideration.

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The glow in the sky in upper right-hand corner looks like a UFO, but it's a lens flare made when the Air Force shot this picture of a full moon. They say most UFO pictures result from camera faults

His chief aides include Dr. Robert J. Low, a meteorologist; Dr. Franklin E. Roach, an astrophysicist and airglow specialist; and, significantly, Dr. Stuart W. Cook, chairman of Colorado's psychology department. Many skeptics claim most saucers originate in the minds of the viewer. Regardless of their backgrounds, all his aides share Condon's objective approach and his feeling that more information is needed to determine the origin of UFOs.

Nothing hidden. The Condon team has complete access to the files of Project Blue Book, the Air Force office for UFO investigations. There are over 15,000 UFO reports in its files—about 20 percent of these sightings truly unidentified.

Maj. Hector Quintanilla Jr., director of Blue Book, says Condon's aides have asked only for about 400 case histories of the older saucer sightings. These are the classic cases that have been extensively written about in UFO literature.

Although Project Blue Book continues to investigate saucers, it gets nothing in return from Condon's team. "It's a one-way street," Quintanilla says. "I don't want to bias him in any way, so I don't request anything from him."

Condon and his aides have conferred with Dr. J. Allen Hynek, chairman of Northwestern University's Department of Astronomy and scientific consultant to Project Blue Book, who has looked into many of the Air Force's most puzzling cases. They also questioned Air Force scientific adviser Jacques Vallee on the methodology employed in Project Blue Book's investigations.

The conferences were followed by a meeting last June at the University of Colorado, which was attended by about 100 of the 140 Air Force UFO investigating officers—every base has one—to tighten report procedures in an attempt to gain a more scientific description of saucer sightings.

Condon has not confined his inquiries to Air Force and scientific personnel. He has also called in some of the Air Force's severest critics to get their views on saucers. Officers of the National Investigations Committee on Aerial Phenomena (NICAP), an organization that believes there's something to flying saucers, have visited Boulder to submit evidence. Retired Marine Corps Major Donald E. Keyhoe and Richard H. Hall, NICAP's top officials, have occasionally consulted

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with Condon's group—to review the organization's documented sightings.

Hall says Condon is making a broad frontal attack on the whole problem and "I couldn't be more pleased." Asked if he thought Condon might whitewash the saucer mystery, Hall says, "I don't think he would."

Even the "kooks." Condon is willing to listen to anyone involved in saucer sightings—even the "kooks," as Hall puts it. He recently attended a saucer congress in New York City that heard many of the way-out believers and "contactees" (those who claim to have contacted saucer crews from outer space). One of the speakers at the Congress was Vi-Venus, who claimed she was from the planet after which she was named. Hall says this type gives serious saucer researchers a black eye and NICAP boycotted the New York congress.

Dr. J. Allen Hynek (left), a UFO watcher of long standing, and Dr. Robert Low, Condon's deputy, conferred recently on how the Air Force investigates reported UFO sightings.

However willing the Colorado researchers are to consider even bizarre "evidence," they are seriously attempting to zero in on UFOs in a scientific manner. They are especially anxious to investigate current cases that can be observed from start to finish.

One of their biggest accomplishments is the establishment of a team of trained investigators around the country, who can get to the scene of any important UFO sighting within 24 hours with cameras and other equipment.

The Condon group also hopes police departments will make efforts to get photos of UFOs that can be scientifically analyzed. They have devised a meticulous questionnaire for saucer reporters to fill out—size, shape, color, motion, and other characteristics. The answers are fed into a computer and the scientists hope eventually to discover additional patterns of saucer phenomena.

The Colorado investigators follow up the questionnaires with phone calls to the persons from whom reports originate. If they cannot clarify a report in a phone conversation, and the sighting is deemed of sufficient importance, investigators go to the scene to check it out.

An eye on the scene. Some cases yield solutions easily when investigators get a first-hand look at the scene. In a recent Connecticut sighting, for example, a "glowing object" turned out to be an electrical arc, created when the wet branches of trees slapped against, and short-circuited, a power line. But other cases continue to puzzle investigators.

Two of Condon's team recently traveled to the Winnipeg, Canada, area to investigate a weird story of a man "burned by the exhaust of a saucer." The victim claimed he spotted a strange, saucer-like vehicle in a clearing as he walked through the bush. When he approached the vehicle, he heard vocal sounds coming from inside. He peered in the open hatch and the vehicle suddenly took off in a vertical

Can UFOs affect cars?

Frederick J. Hooven, an expert on automotive electrical systems for the Ford Motor Co., says the possibilities might include magnetic interference, neutron bombardment, or some other form of radiation.

An intense magnetic field could interrupt a spark inside a cylinder and stop the engine. But Ford found it would take a force at least 250,000 times greater than the earth's magnetic field to magnetically freeze an engine. Such a force, however, would not only stop the engine, it would also bend the frame to conform to the shape of the magnetic field, or even tear it apart.

Hooven and another Ford scientist, Dr. Anthony Arrott, examined a car that reportedly was mechanically affected by a UFO earlier this year in a Detroit suburb.

They checked the car with a gaussmeter, a device that measures magnetic fields. The

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rc, created when a wet branch slapped a power line

climb, emitting a jet exhaust that burned him.

The man struggled out of the bush with burns that actually required hospital treatment. But when released, he was unable to lead the scientists to the clearing. The site is still undiscovered.

Because of such frustrations, the Condon group is hoping for an opportunity to use technical equipment that could yield scientific data more precise and easier to analyze than the testimony of witnesses. But there has been no opportunity to capture a UFO in the act.

While they wait for such a break, the Colorado scientists are attempting to check scientifically some of the strange things that reportedly have occurred when UFOs have been spotted—power failures and car engines going dead. More than 100 cars have gone dead after drivers reported they saw a UFO.

Every power failure attributed to UFOs is being scrutinized. Condon's group has approached a number of power-company experts for aid in pinpointing the cause of each power failure.

When will the Condon group complete their work? Their research should be wrapped up by mid-'68 when preparing the report—certain to be a best seller—will begin.

Before the report is released to the public, it will be reviewed by a special committee of the National Academy of Sciences. They will check the Condon group's scientific methods and determine whether their conclusions are scientifically valid. After the Academy approves the report, it will be made public.

Will anything be held back? The Air Force answer is that the report will not be classified. The Condon group is pledged to withhold any data on classified aircraft or missiles it might come across in its investigations, but an Air Force spokesman says "everyone knows practically everything we have now."

Can you trust the upcoming Condon Report? The editors of POPULAR SCIENCE believe you can. The reputation and character of Condon and his aides insure that this study will be no whitewash, as some predict, but will lay the groundwork for a better understanding of UFOs in general and reports of sightings in particular.

The great UFO probe should also set better standards for continuing studies of flying-saucer reports and the related mysteries of the universe in which we live. PS

How it all started

Although some believers in saucers say UFOs have been appearing since biblical times, the first sighting is attributed to Kenneth Arnold, a pilot who saw a group of bright flashes approaching Mt. Rainier, Wash., at high speed on June 24, 1947. Arnold described them as "like saucers skipping across water." Newspaper reports soon dubbed the UFOs flying saucers. Air Force and scientific investigations of the Arnold sightings have failed to explain the phenomenon, although no one doubted that Arnold, an experienced pilot, did observe something.

The publicity of the Arnold sighting led to a rash of other reports that summer. Upwards to 15,000 UFO reports were made in the following two decades. About 80 percent of the UFOs are readily identifiable, but about one in five can't be explained by the Air Force.

car showed no more magnetism than other cars in the parking lot at Ford's Engineering Center in Dearborn. Since steel has an excellent "memory" for magnetism, this proved that the car had not been subjected to a large magnetic polarizing field. And had it been subjected to demagnetization after first being stopped by a magnetic field, it would have registered zero polarity rather than the normal amount found.

The scientists also reported that neutron bombardment could stop a car, but not without destroying it *and* the occupants. Neutron bombardment could change the structure of a car's metals, destroy its rubber and plastic insulation, and short out its electrical system, Ford says. But then an automobile subjected to such forces couldn't run again after the UFO flew off.

Most of the complaints have listed temporary malfunctions impossible for UFOs to produce, according to the Ford scientists.

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Hardboard Boat Cover Resists Moisture

With this hardboard cover, you can protect your boat in wet weather without filling up the garage or buying a cover, and do it for less than $10. This one isn't meant for the road, but it works fine for storage.

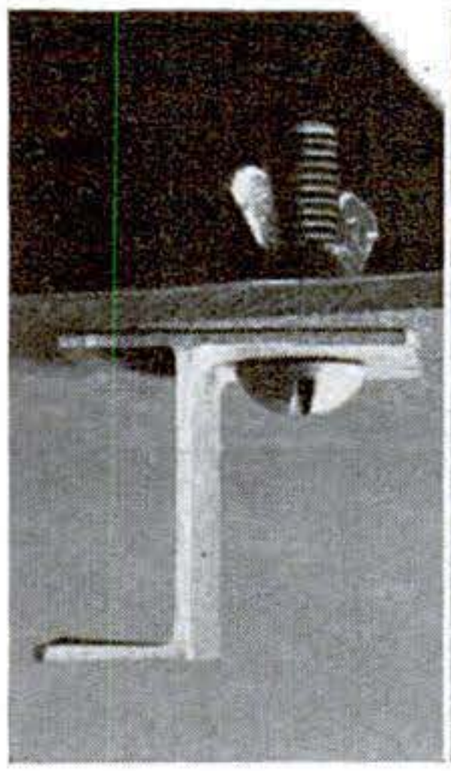
Here's what you need for a 12′ boat: three pairs of boat-cover sockets, three ⅛″-by-4′-by-6′ panels of waterproof hardboard, two feet of aluminum H channeling (¼″ wider between legs than the boat gunwale), three pine ribs, and various nuts and bolts. Needs may vary for other boat sizes.

Working from the stern, screw the cover sockets opposite each other in three positions, ¼ of the way, ½, and ¾ up the boat length, flush with the gunwale (see photo). The ribs—¼″ thick are best—are set in the sockets with a 6″ rise at center.

Lay a piece of hardboard over the rib nearest the stern, with a 4″ overhang, and clamp it to the gunwale. Cut the channeling into a dozen 2″ clamps, removing half a leg, as shown. On the port side, drill the holes, set the clamps in place on the cover's underside, and bolt them down tight. The U sections of the clamps will grip the boat's gunwale when the storage cover is in place.

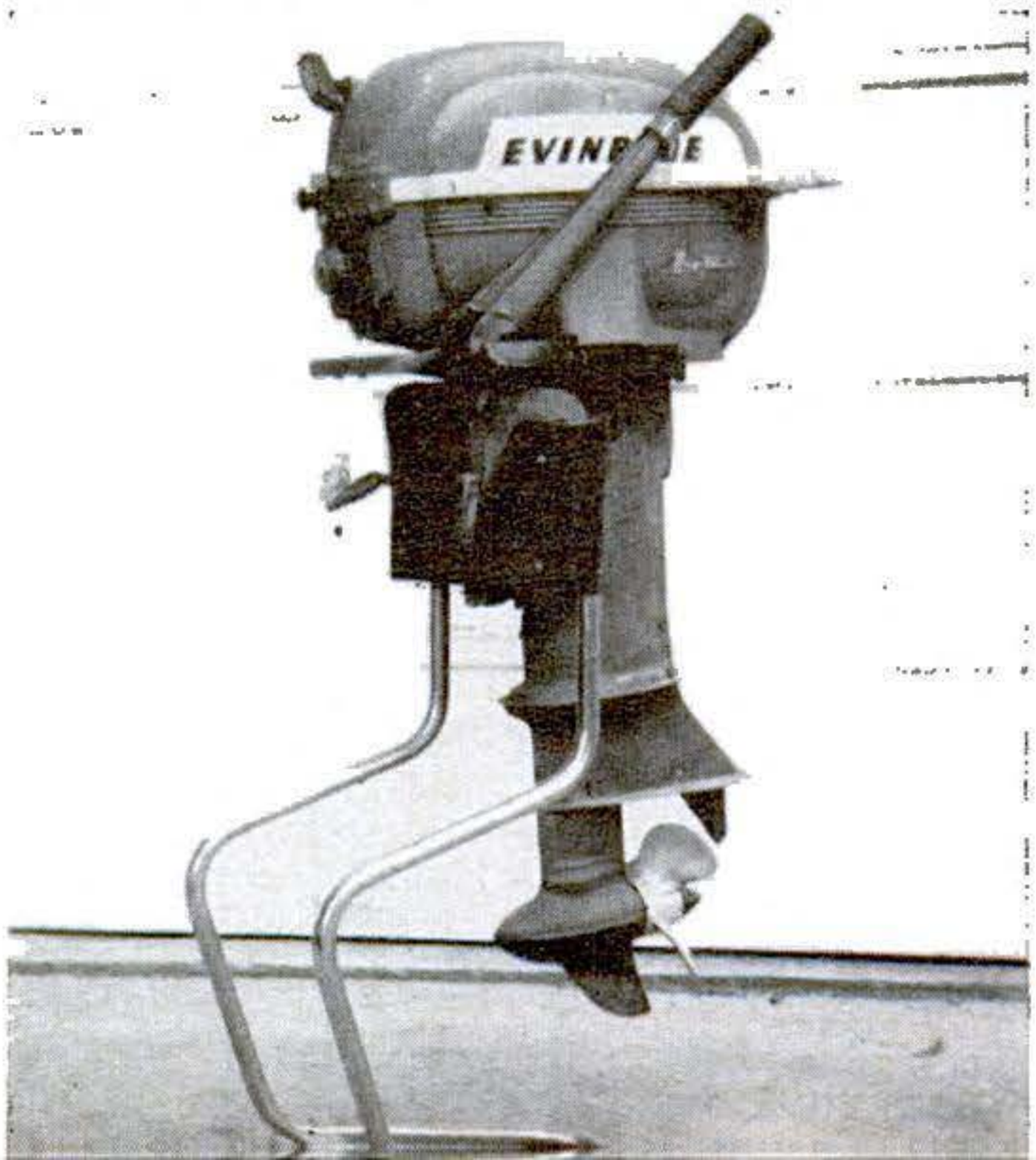
Starboard, the cover holes are slotted for sliding the clamps to remove the cover. Fasten these with rustproof washers and wingnuts.

Install the other two panels the same way, each with a 3″ overlap. Finish up by cutting the hardboard to shape with a couple of inches overhang all around. Coat the cover with marine or exterior paint.



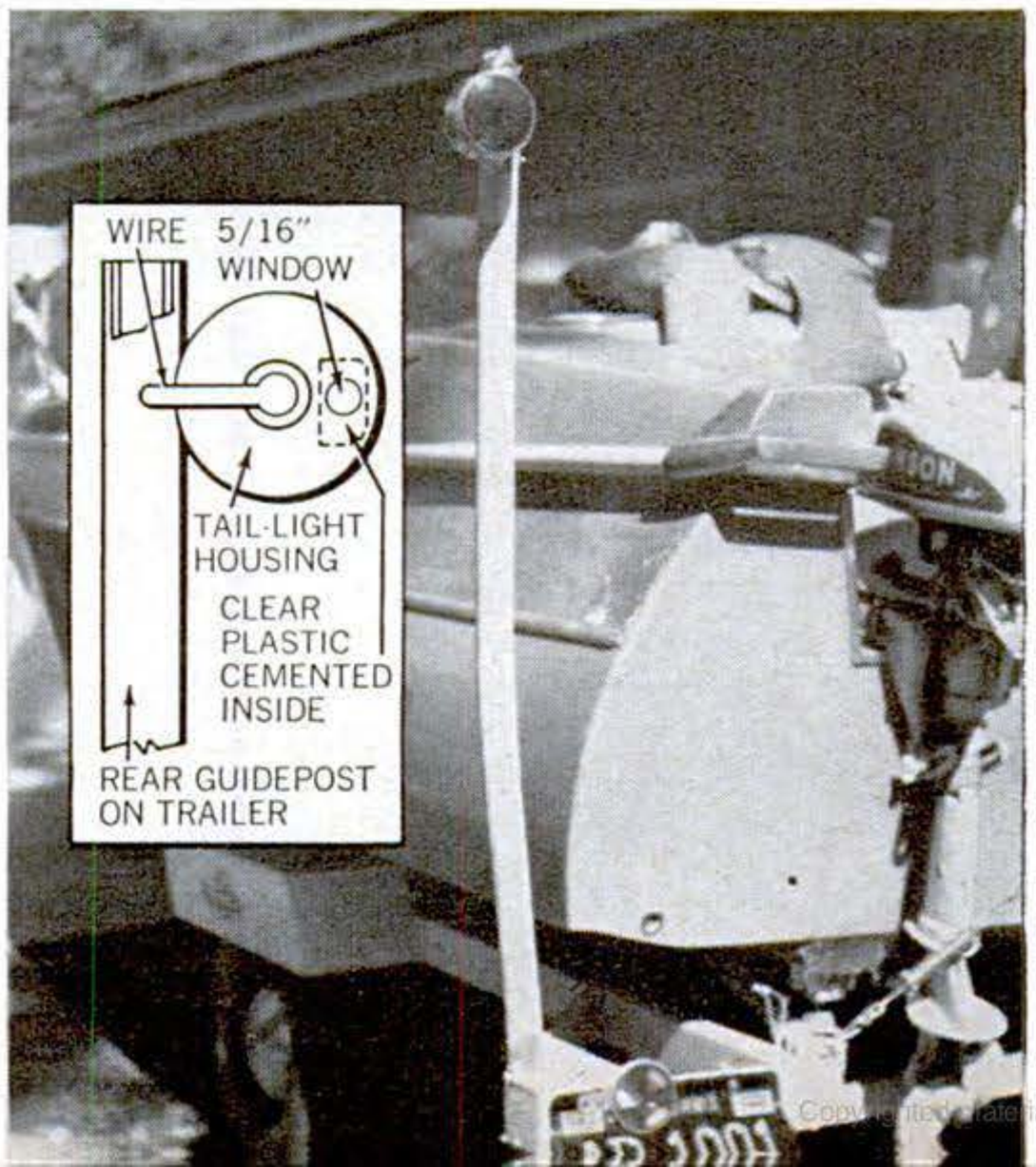
Kitchen chair makes outboard stand

An old metal-tubing chair makes a fine portable outboard-motor stand. Bolt a "transom" of heavy plywood to the top, a two-by-four across the open section of the base. Bend the tubing to balance the motor, then add roller-skate or larger caster wheels.



Guide poles keep lights dry

Boat-trailer lights on guide poles make them more visible and keep them out of the wet. A small hole in the back will let you see from the car seat whether a tail light is working. Cement glass or clear plastic over the hole on the inside.



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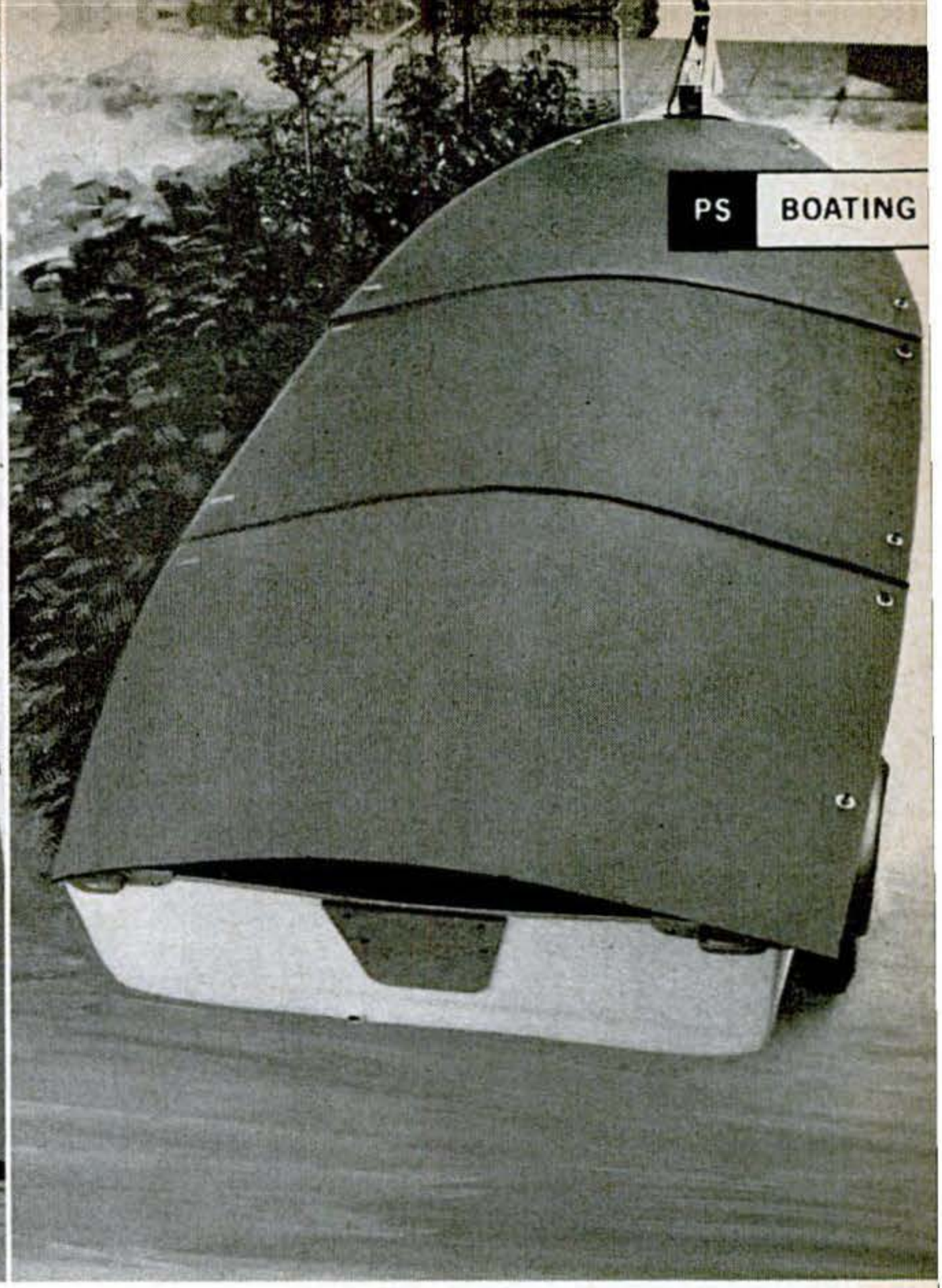
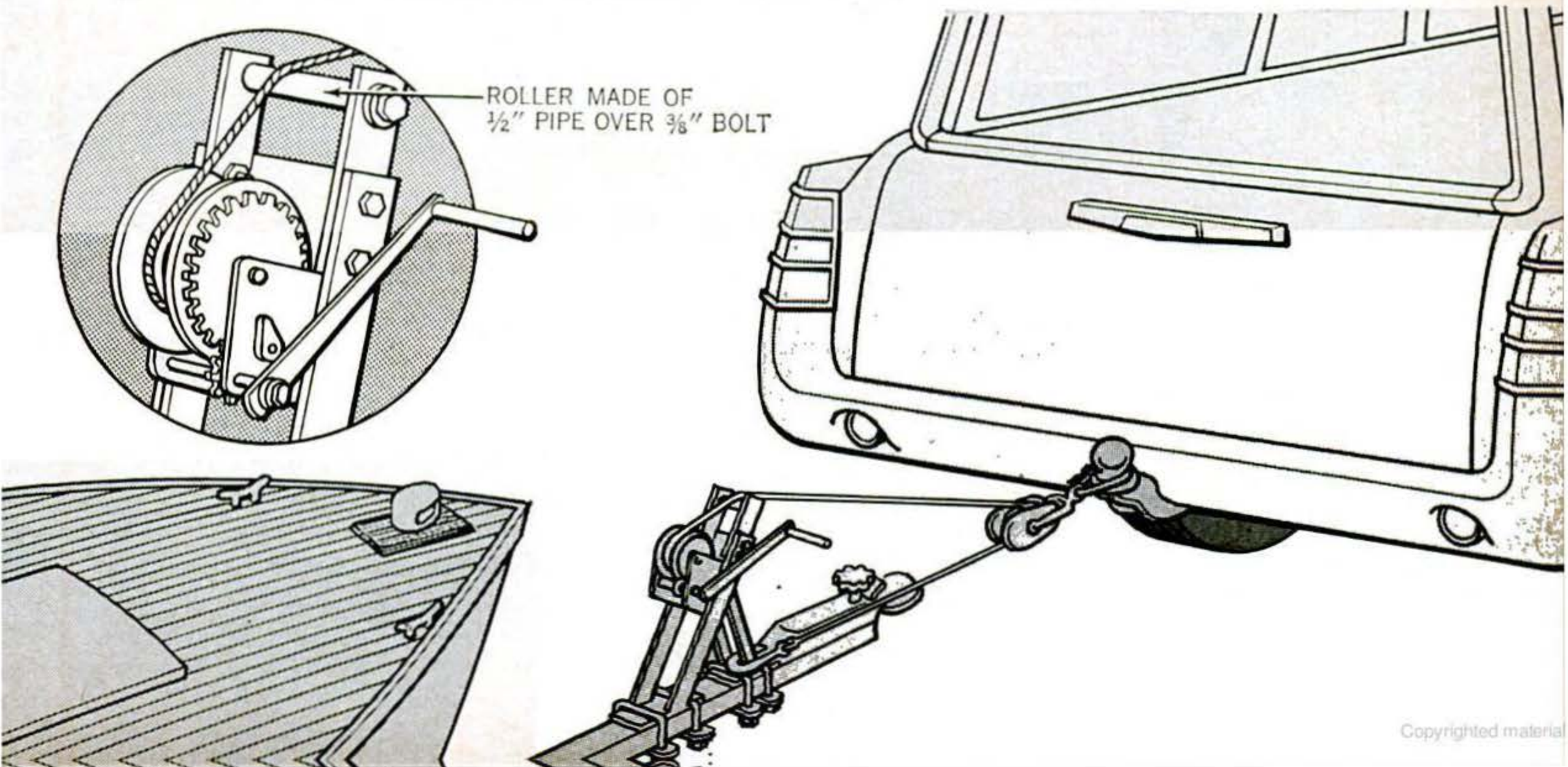


For outdoor storage, turning a boat over is a back-breaking job. The use of the usual canvas cover instead serves merely to hold in moisture while keeping the air from circulating. The hardboard cover shown here was designed to overcome these problems. You can build one for as little as $10.

Boat winch helps to pull a trailer when the going is really tough

This rig can be very handy when you're pulling your boat and trailer up to the car in tough situations. Reverse the normal direction of the boat-winch pull by threading the cable over pipe on a ⅜" bolt through the top of the winch frame. On a gentle slope, hook the single line to the car. In heavier going, attach a snatch block to the trailer-hitch ball, thread the cable back to the winch, and hook it. This works great for pulling or moving the trailer in shallow water or up a steep grade.



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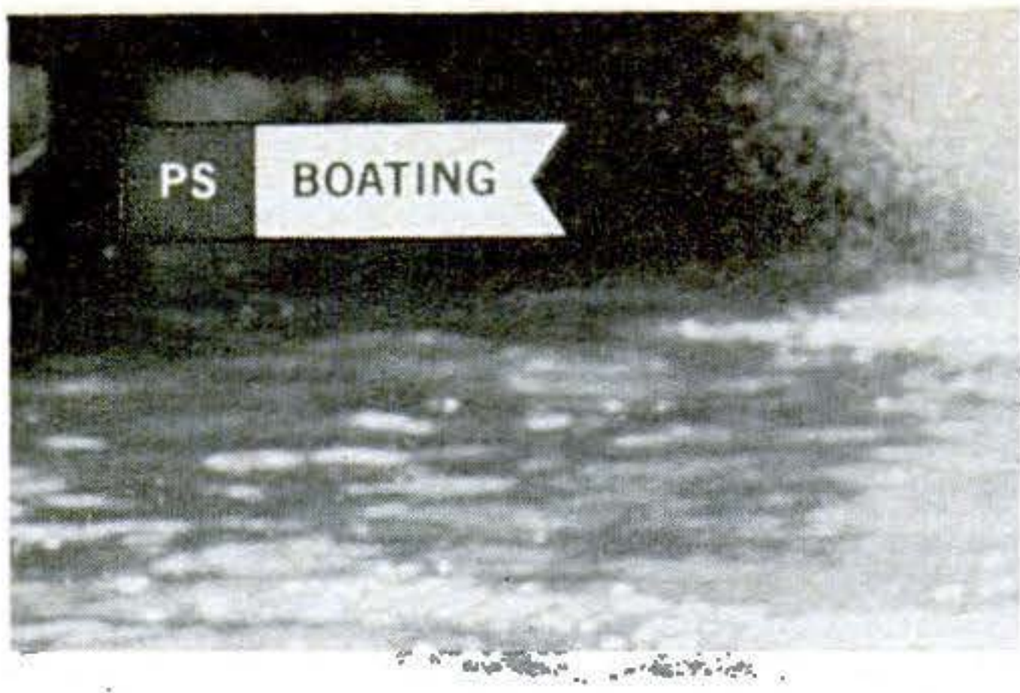

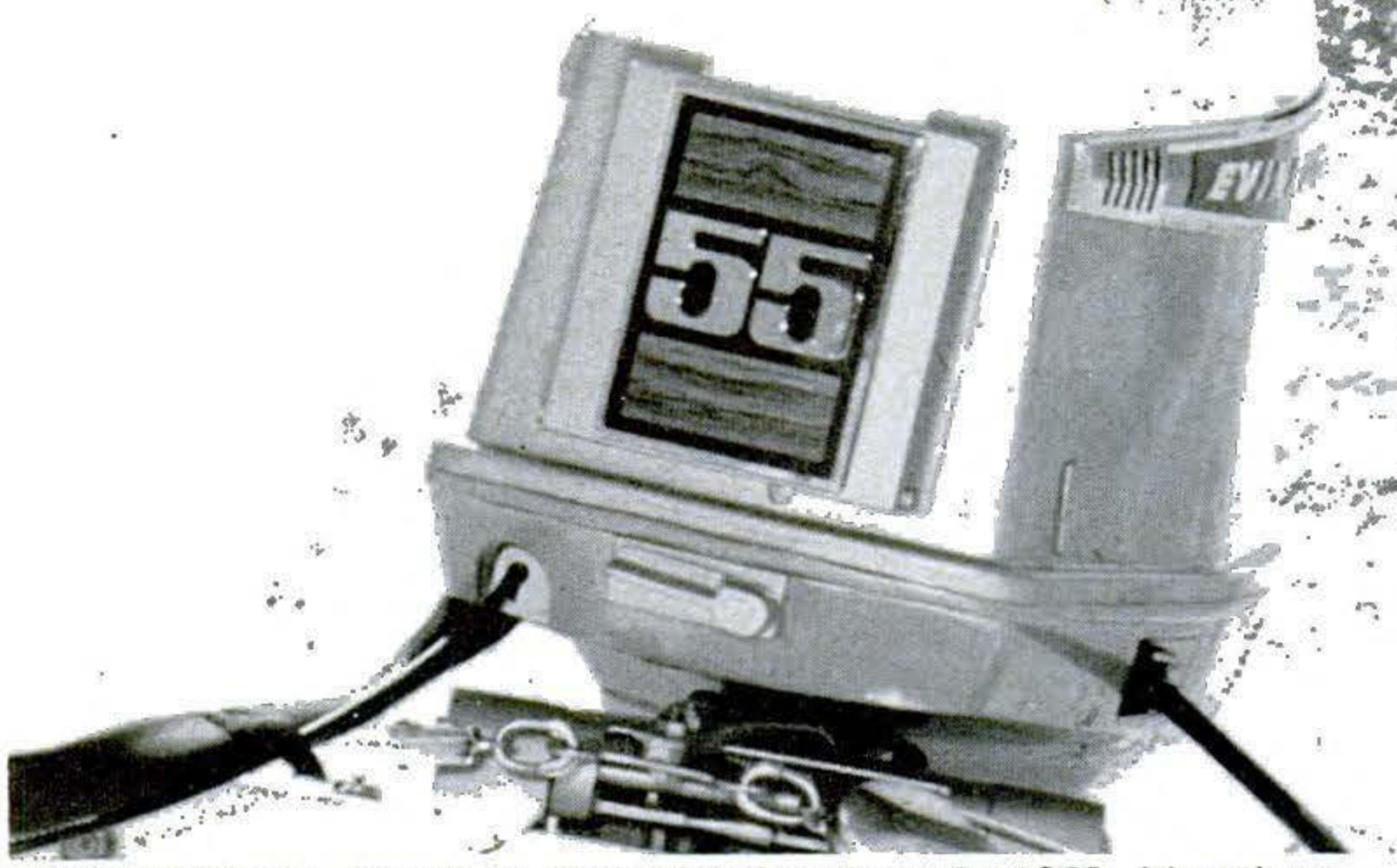

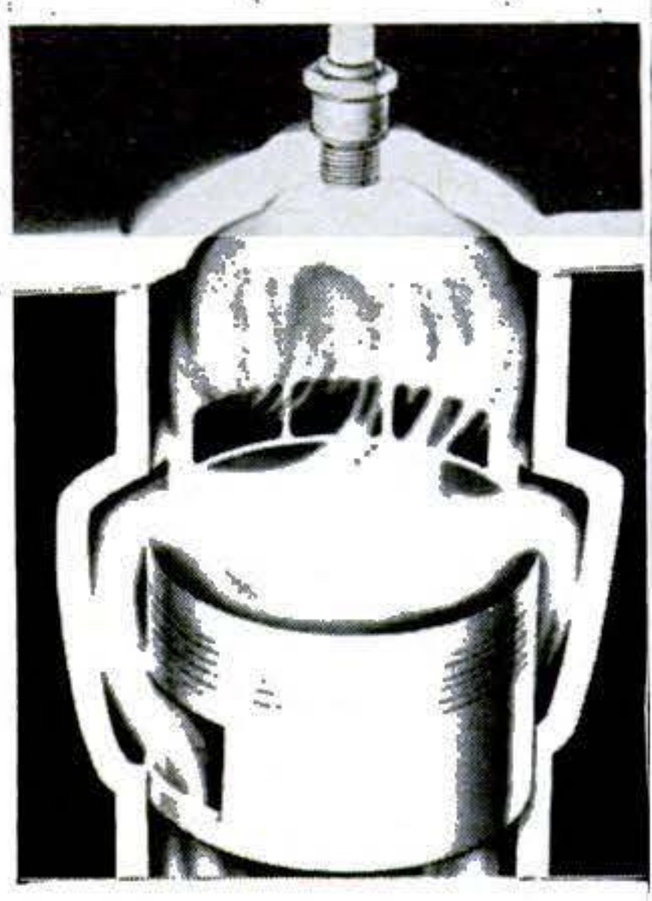

EVINRUDE **The 55-hp. Triumph** is brand new for 1968. It's a three-in-line. Inset at right shows new fuel-flow system. Upward-slant intake ports, one on either side of the cylinder, feed incoming fuel directly into the top of the combustion chamber.

THE '68 OUTBOARDS

. . . with a new high in horsepower a new three-in-line 55, and lots of new fishermen

Gather 'round for a preview of the behind-the-transom powerhouses the engineers have cooked up for you this year. The horsepower lid has been lifted again —to a mighty 125 in a Mercury. Evinrude and Johnson have each unwrapped a brand-new three-cylinder 55-hp. three-in-line. And Chrysler has added a school of fisherman-size motors.

The Evinrudes. Take a look at that new three-cylinder pictured at the top of the page. It's called the Triumph, an appropriate name for a motor with plenty of low-speed thrust for water skiing, *and* a high enough top speed for the wind-in-

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MERCURY **Meet the new horsepower champion**—the mighty Merc 1250. A six-in-line, with 99.8-cubic-inch displacement, it packs a 125-hp. punch. Mercury's Thunderbolt ignition and silencing system give it long spark-plug life and silent running even at high speed.

ARE HERE!

By JIM ROE
PS Boating Editor

the-hair set who'll want to clamp it on the transom of a racing-type runabout.

The Triumph has a newly designed fuel-flow system that allows the use of lighter pistons for high-speed running and a higher compression ratio for power and fuel efficiency. It also has a special gear case, propellers of a new design, and a prop-hub exhaust. A converging ring at the rear of the exhaust squeezes the water flow in and helps add to the thrust of the prop. Pushbutton gearshifting and a built-in alternator and electric choke are all standard.

The top horsepower job is still the big X-115—a maxi-

Continued

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Newest and smallest of the Evinrudes, this is the 1.5-hp. Mate. A single-cylinder motor, it weighs only 18 pounds, but it's completely self-contained, with a built-in fuel tank. The bantamweight motor is a happy choice for canoes and small sailboats and fishing boats. It's easy to carry, and a folding steering handle adds to its portability. On the water, the Mate boasts 360-degree-pivot steering.

mum-performance engine with minimum-drag gear case and high-thrust gear ratio. At the other end of the Evinrude power scale is the brand-new 1.5-hp. Mate. With a weight of only 18 pounds and a self-contained gas tank, it's easy to cart around. Yet it has plenty of power to push a small fishing boat, canoe, or small sailboat. It gets along on one hard-working cylinder.

In the middle range, they've increased power in the V-4 line, producing a 65- and 85-hp. Evinrude for the first time. All the V-4s have capacitance-discharge (CD) electronic ignition. And the three-hp. models for 1968 look smaller than before, since the integral tank has been eliminated in favor of a separate three-gallon fuel tank. The powerful and popular 100-S, Evinrude's top family outboard, has an improved spark-throttle relationship this year to make for better low-speed operation.

The Mercurys. The new heavyweight champion of the outboard world—the Merc 1250—is a six-in-line, 99.8-cubic-inch power plant. Although it delivers a mighty 125 horsepower, it is designed for family boating as well as racing enthusiasts. Its ignition is Mercury's Thunderbolt system, also used in other 1968 Mercurys. This CD system, say their engineers, eliminates breaker points and the need for retiming. It also gives quicker and more dependable starts and lengthens spark-plug life to up to 700 hours.

CHRYSLER **Whatever your favorite sport**—whether it's fishing, family cruising, water skiing, or skin diving, there is one or more new Chrysler outboards tailored exactly to the job. They range from 4.4 horses to 105. All new for 1968 are eight new fishing models, all under 10 hp. And the new Magnapower ignition on the big 75- and 105-hp. motors gives faster starts and stretches spark-plug life. Chrysler outboards have power heads with oversquare big-bore cylinders (the diameter of the piston is greater than the stroke). This design cuts down friction and enables the engine to wring full power from every drop of gasoline. 1968 Chryslers have advanced full-length acoustical silencing chambers, too. These provide quietness without adding materially to the weight.

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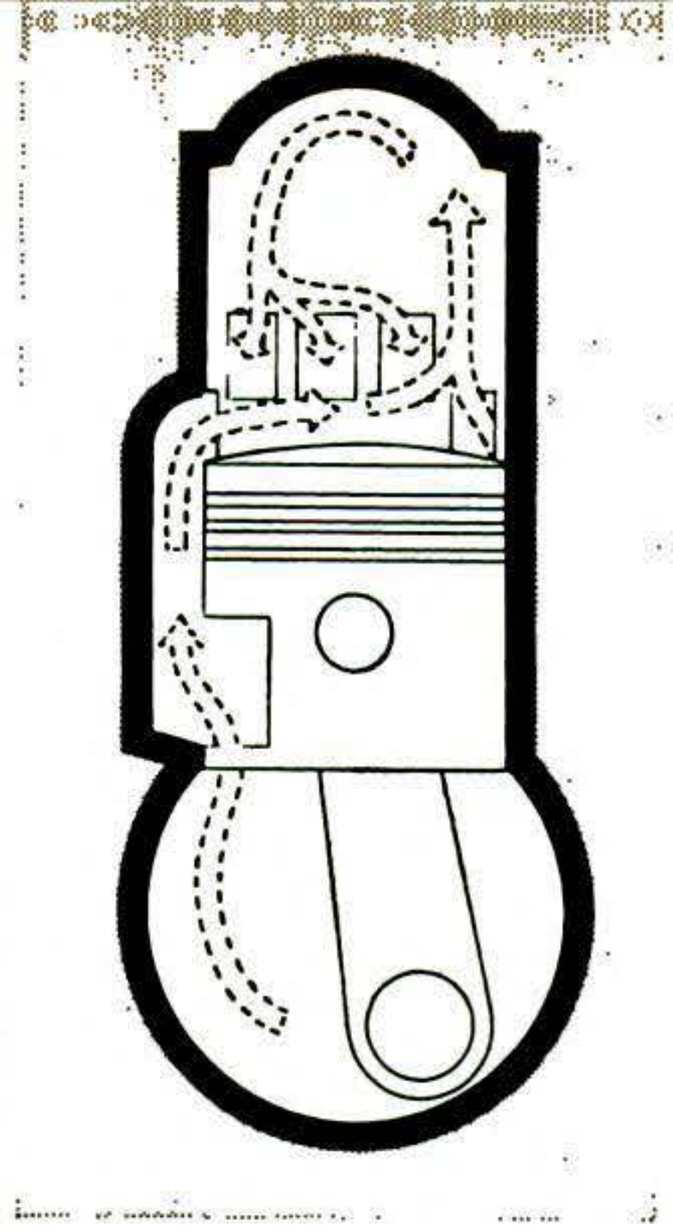


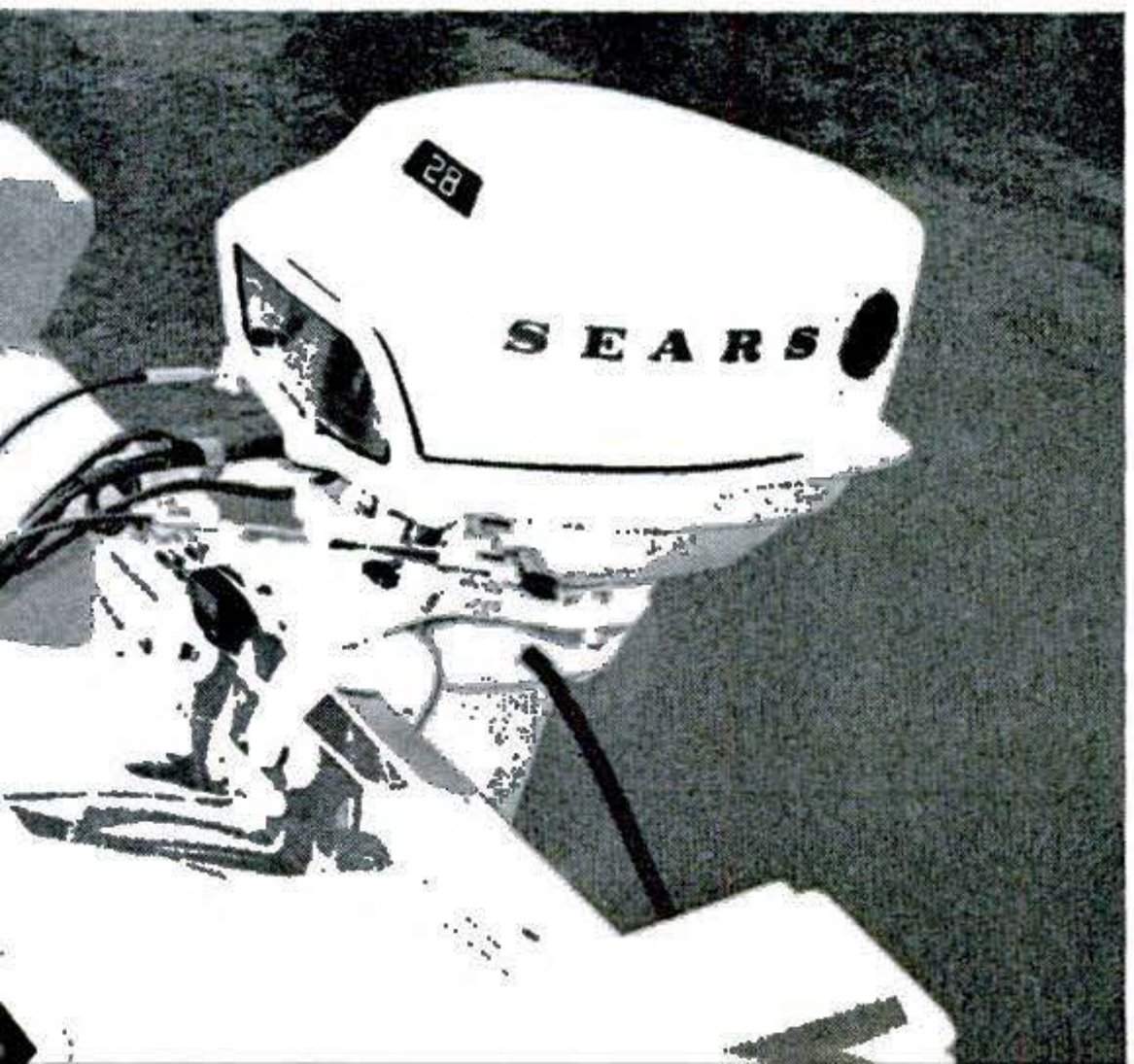
JOHNSON The newest stars here are in the medium- and low-horsepower ranges. Photo above shows the new Sea-Horse 55 (at left) and the new 1.5 Sea-Horse. The 55 is a three-cylinder, in-line motor—a loop-charged design, as seen in the sketch at right. This permits a smoother gasoline flow, less exposed piston area, lighter pistons, reduced bearing load, and a higher compression ratio. The 55 uses an almost-flat-domed piston, running in a cylinder with two intake ports slanted to make the fuel charges converge and flow toward the cylinder head. This leads the charges over the spark plug, then out through the exhaust ports on the opposite side of the cylinder. The 1.5-hp. Sea-Horse weighs only 19 pounds, carries its own self-contained fuel tank.

The Merc 1250 has a completely new power head, with newly designed pistons, connecting rods, and crankshaft. Its new carburetors have aircraft-style boost venturis for greater acceleration and improved low-end torque. Big, fast, the Merc 1250 can win a race for you on Saturday, and take you for a quiet ride around the lake with the family on Sunday.

There's a new 100-hp. Merc 1000, and the 20-hp. Merc 200 can now be equipped with electric starting. The '68 Mercs have the tried and true jet-prop underwater exhaust, Power-Dome combustion chambers, and fixed-jet carburetors. The

Continued

SEARS This one puts 28 horses into your boat —it's only one of nine Sears outboards for 1968. They range from four hp. to 75. The two-cylinder 28 below is electric-starting, alternator-equipped. It swings a propeller measuring nine by 10 inches, and weighs in at 102 pounds. Lower unit is offset two degrees to counteract prop torque. This gives easier steering, say Sears engineers.



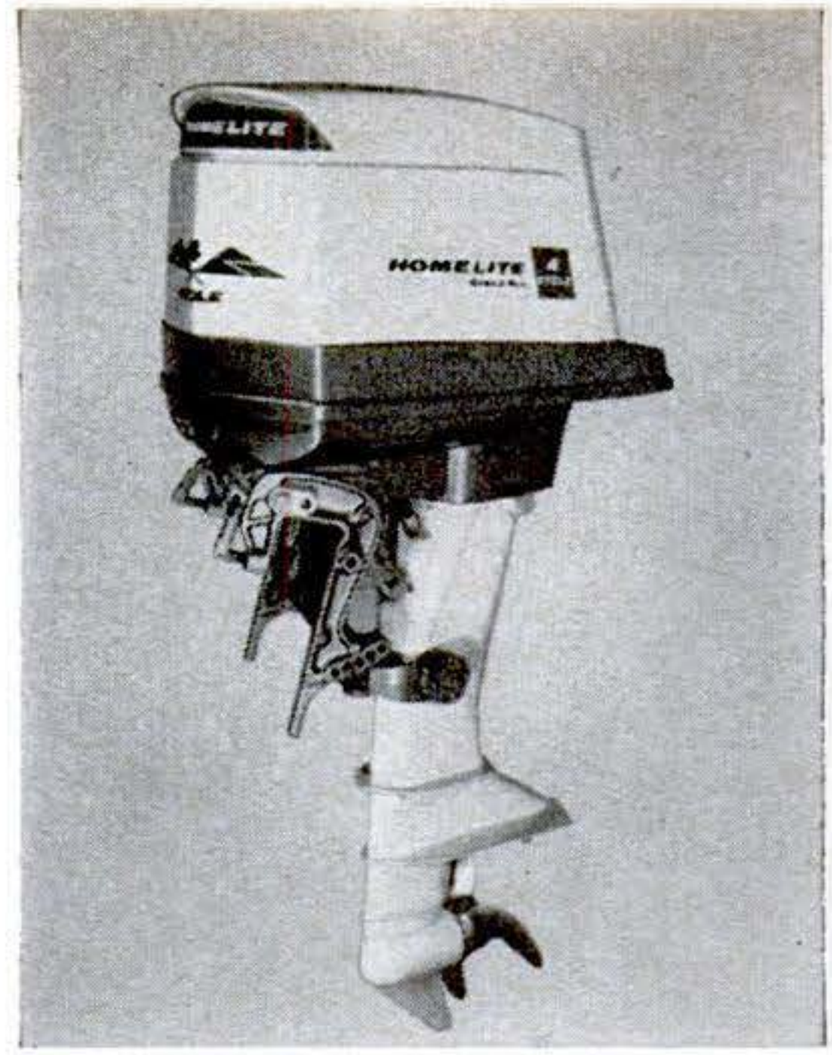
OUTBOARD JET For a real departure from the norm, here's an outboard with no propeller at all. The new OJ-200's jet pump is flush with the bottom of the transom, promising you safe operation in shallow water or around swimmers. The two-cylinder motor has a 16.5-cubic-inch displacement, weighs 57 pounds, and turns out 9.5 horsepower.

McCULLOCH

Especially interesting to fishermen and outdoorsmen are the 7½- and nine-hp. electric-starting motors. Low in profile, light for easy handling, they have full gearshift.

HOMELITE

No engineering changes in this four-cylinder, 55-hp. straight-gasoline burner. But a new system has been set up to give Homelite owners 24-hour parts service anywhere in the U.S.



aluminum drive shaft and lower-unit housings are one-piece die castings. Self-sacrificing trim tabs aid steering and protect parts under water from galvanic corrosion in salt water.

The Chryslers. The big news is eight all new fishing-model outboards. All are under 10 hp., in ratings of 4.4, 6.6, and 9.9. All have a compact, lightweight, low-profile design. And all feature a depth-minder drive for shallow-water operation: The propeller runs five inches above its normal level. A low intake insures that the motor gets a sufficient flow of cooling water.

Chrysler has some big news, too, in its big motors--the 75-horse and rugged 105. Both are equipped with a new ignition system called Magnapower. This one is said to supply more than twice as much electrical energy to the spark plugs as some electronic systems. Chrysler engineers credit this achievement to a new and higher-efficiency coil design, coupled with more reliable and accurate contacts to trigger the capacitor discharge. Magnapower ignition is said to provide greater ease of starting, prolonged idling without engine misses, and faster acceleration. Its new circle-gap self-cleaning spark plugs last up to 10 times longer.

The Johnsons. The new Sea-Horse 55 is an all-purpose motor. It's great for family cruising, makes a fine water-skiing power plant, and at 49.7 cubic inches, fits neatly into the American Power Boat Association's class E. The three-cylinder 55 is designed with loop charging. This permits a smoother gasoline flow, less exposed piston area, lighter pistons, reduced bearing loads, higher compression, and a higher ratio of power per cubic inch of displacement.

A flat-domed piston runs in a cylinder with slanted intake ports to make fuel charges converge and flow toward the cylinder head over the spark plug, then down and out through the exhaust ports. The flat piston dome and specially shaped cylinder head give smoother and more efficient combustion than can be attained in more conventional cross-flow engines.

With less surface exposed to hot gases, the thinner and lighter piston runs cooler, making possible the high compression ratio. The exhaust is expelled through the propeller hub.

Johnson's Hydro-Electric transmission, combining electric power shifting with a mechanical shift clutch, is standard on the 55. A hydraulic pump inside the gear case utilizes the gear case's lubricating oil to supply the force needed for shifting gears. A remote-control solenoid operates the valves of this hydraulic shift. An extremely "clean" gear-case design limits drag. Large-diameter propellers have blades with a "high rake." The blades are tilted rearward with progressive pitch.

The new flyweight champion of the Sea-Horse stable is the single-cylinder 1.5. It weighs just 19 pounds, carries its own gas tank along with it. At low speed, exhaust is discharged above water; at high speed, below water.

[*Continued on page 211*]

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What's New for the Outdoors

Mount adapts one scope to all your rifles

This new universal mount for rifle scopes is claimed to be the most versatile ever made. It enables you to use one good-quality scope on all your rifles by simply screwing two studs into the standard scope-mounting holes. The mount attaches easily and can be taken down without affecting adjustments. It sells for $14.95, extra studs for $5. D. P. Bushnell and Co., 2828 E. Foothill Blvd., Pasadena, Calif., is the manufacturer.

Trigger lock insures safety

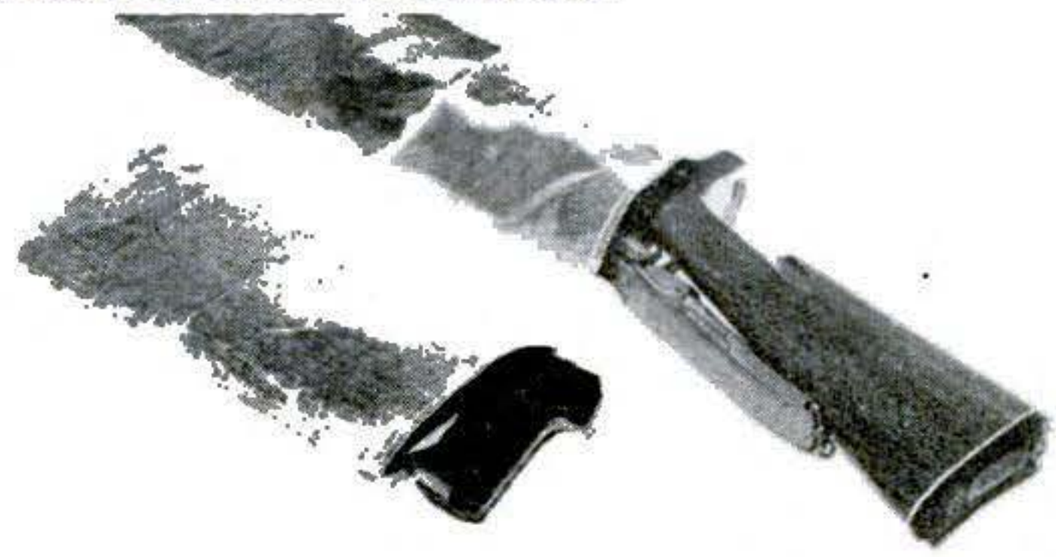
A Cesco gun-trigger lock will keep curious fingers safe when firearms are kept around the house. The lock-and-key device can be inserted or removed at a moment's notice. $2.49. Central Specialties Co., 6030 Northwest Highway, Chicago 60631.

Propane kits for Coleman stoves

If you own a Coleman two- or three-burner gasoline stove, a new kit will convert it to propane. The Paulin C-101 kit costs $7.95 at sporting-goods stores. Paulin Infra-Red Products, 16100 S. Waterloo Rd., Cleveland 44110, makes it.

Slip-on cases of foil and treated paper keep firearms free of rust and corrosion

Impregnated paper bonded to aluminum foil makes cases for storing guns safely without the usual oiling. A vapor-phase inhibitor that lasts three years is said to neutralize any moisture invading the package. The U.S. Government has approved the gun case for military use. Cases for rifles, and shotguns, $1.95; for pistols and revolvers, 95 cents. A & D Enterprises, 420 15th St., Escanaba, Mich. 49829.



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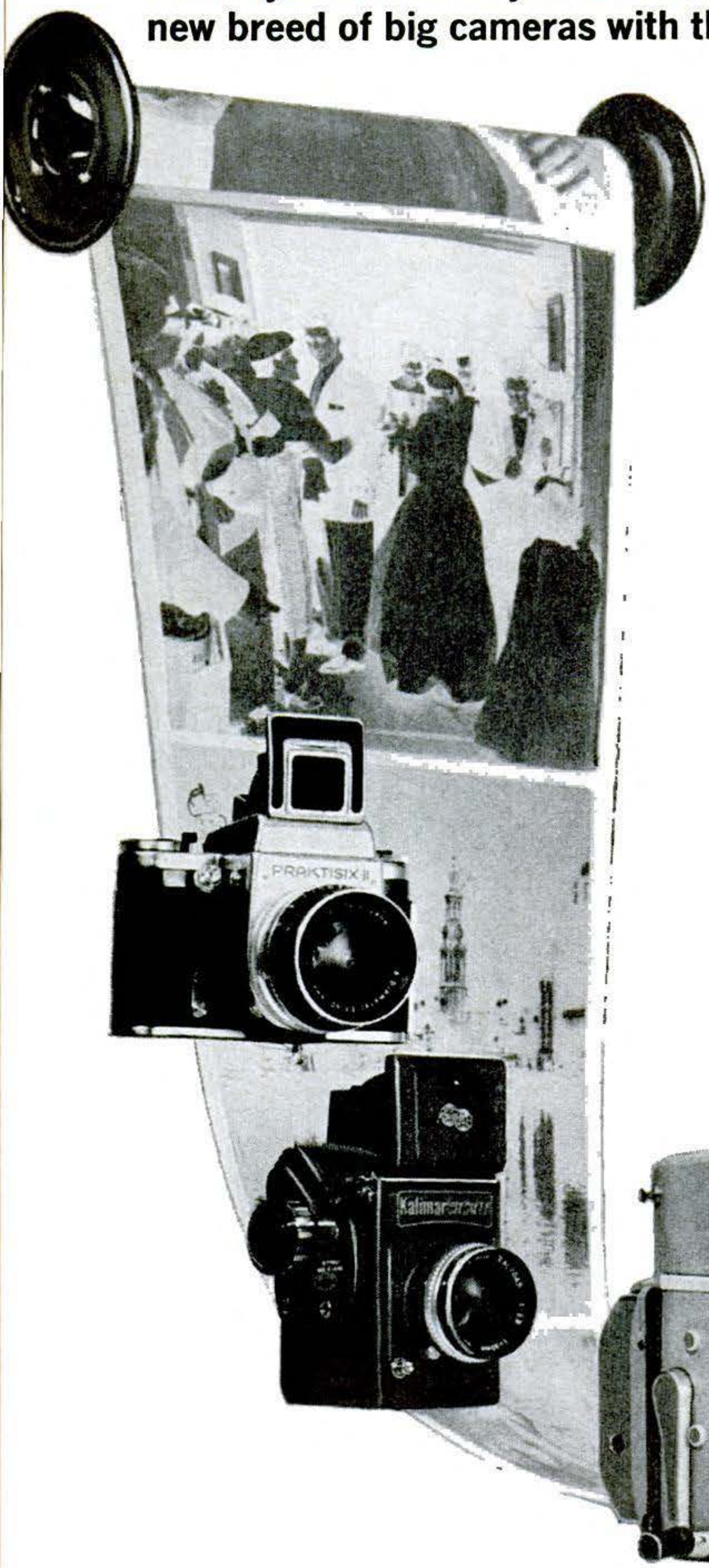
120-SIZE CAMERAS

Good-bye to 35? Not yet. But 35s are being threatened by a new breed of big cameras with the same versatile features



All other things being equal, a good big negative is better than a good small negative. Its larger area packs more information. Enlarge it or project it, and you see less grain, more real detail.

That being so, why did so many pros abandon the big picture in recent years and take up 35s? And why, now, are so many coming back to the 120 jobs?

Fine-grain films and developers were part of the reason for the big switch to 35. They made possible good-quality enlargements with little visible grain. Another part of the answer was compactness. You could carry in a gadget bag lenses and gear that would fill a trunk compartment for a larger camera. Add to that revolutionary developments in lenses: fast enough, with fast film, to shoot under almost any lighting condition.

Add to these quick lens interchangeability. And convenience. And speed of use. And economy. And the overwhelming array of equipment—more varied and more complete than for any other camera size—that has flooded the market.

That's why so many pros and amateurs went to 35. And that's why, as many of these features begin to show up in 120 cameras, photographers are switching back. They can get most of the advan-

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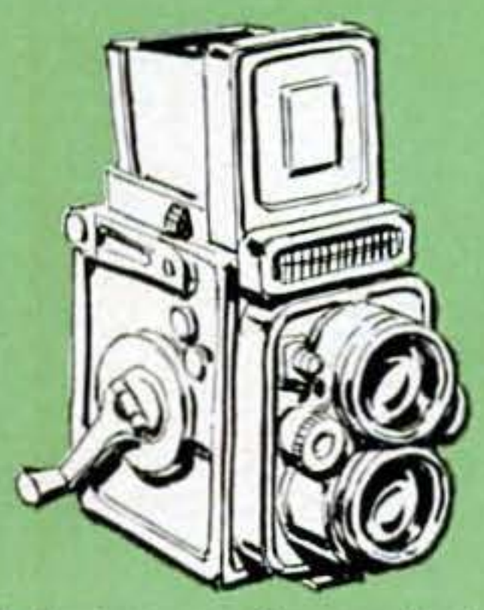
FIGHT BACK

By EVERETT H. ORTNER
PS Photography Editor

QUICK LOOK: HOW THE 120 CAMERAS SHAPE UP



Twin-lens reflexes—Rollei, Autocord, Yashica—are still going strong. But time is running out on this fine design.

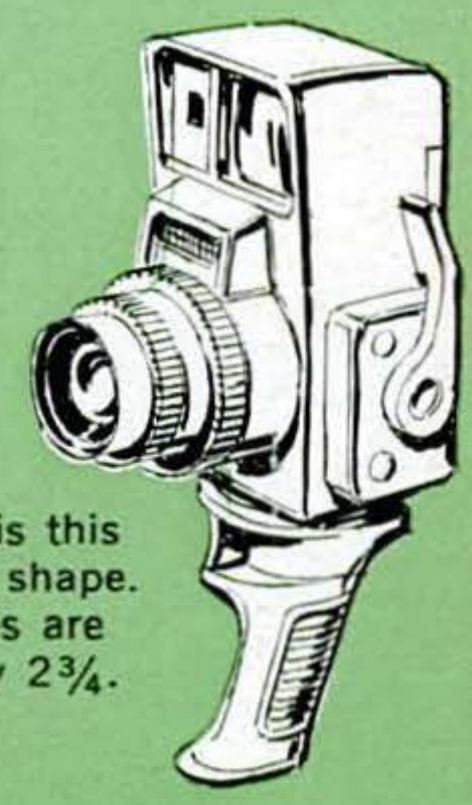
Workhorse jumbos offer more versatility than any other camera. But they're big and heavy, made mostly for pros.

SLR cubes are today's "in" cameras. They're versatile and compact, but also expensive. A favorite with pros.

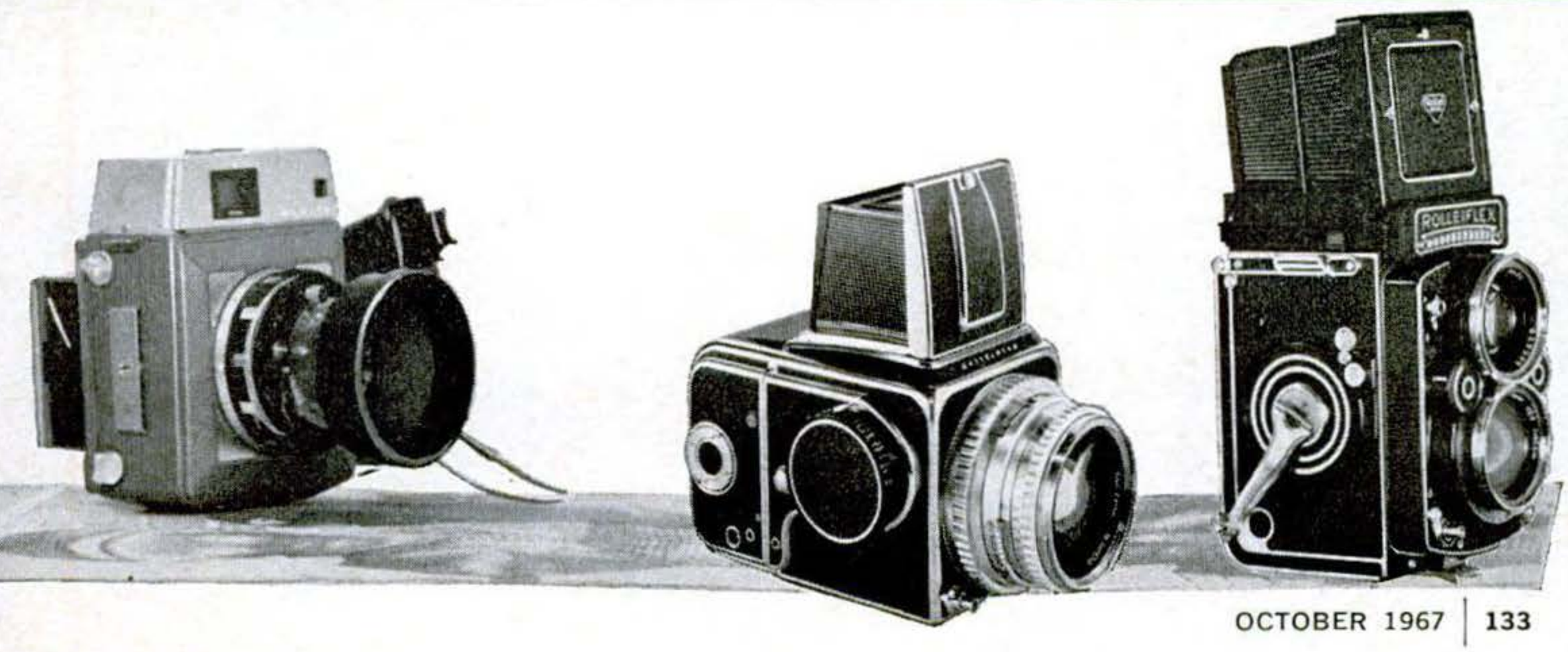
Blown-up 35 could be tomorrow's shape. Praktisix is only one now, but others should come.

The four generic types above represent the shapes of today's 120 cameras. Starting from the left, there's the old champ, the twin-lens reflex, still popular. Rolleiflex was first in this field, but it has many competitors. A modest amount of money can buy a first-class camera here (Minolta Autocord, Rolleicord, Yashica). Next are the workhorse jumbos —big, heavy, rugged jobs, infinitely versatile. They're "system" cameras: You buy a body, add lenses, backs, accessories to convert them to any use. Examples: Mamiya 23, Koni-Omega Rapid, Graflex XL, Linhof Press. Next are the SLR cubes. Hasselblad was first, followed by Bronica and now Rollei with its 66 model. They offer great versatility in a small package. The big names are expensive: $380-$1,000. One reasonably priced camera in this class is the Kalimar Six Sixty ($200). At top right is the "blown-up 35." Right now, only Praktisix is in this class, but more should be coming up. At right is the Linhof 220, a completely new design.

Continued



Loner is this Linhof shape. Pictures are 2¼ by 2¾.



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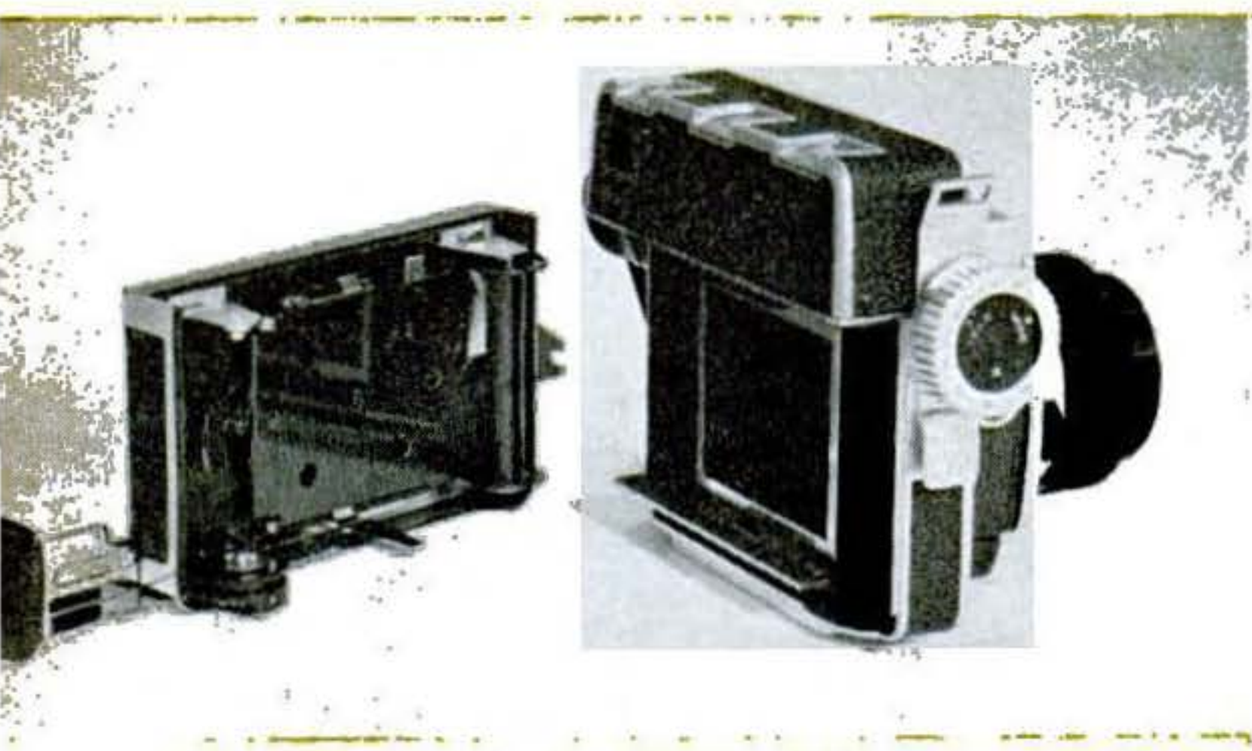
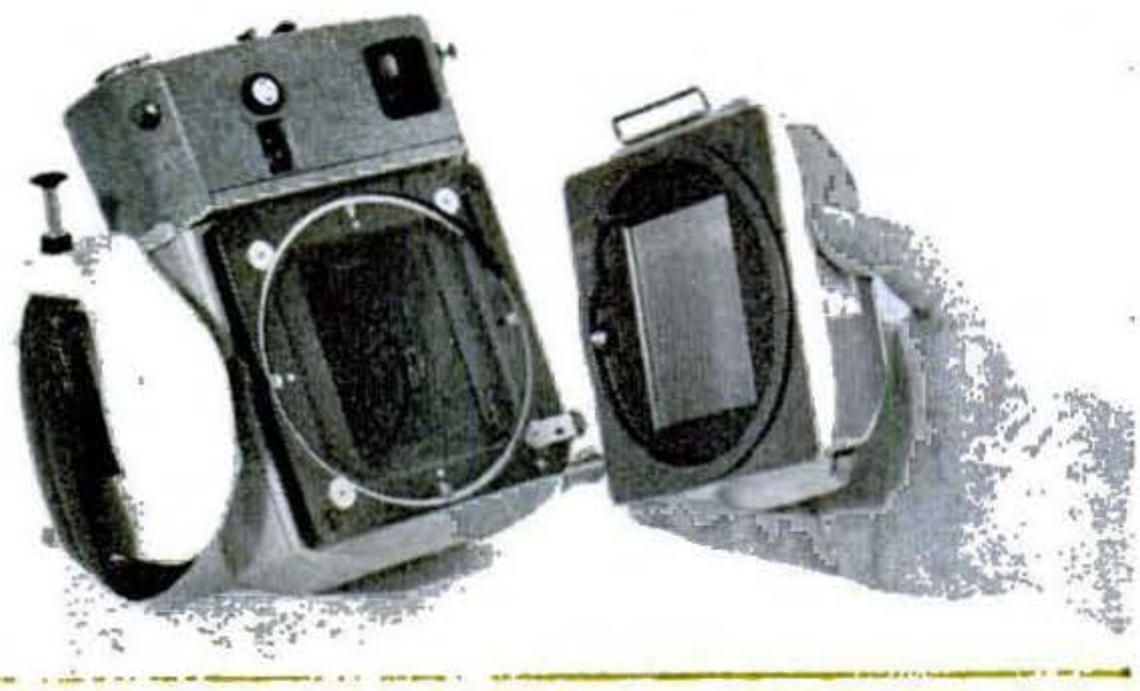
All the new-breed 120s are versatile,

Pentax 220, exhibited in prototype form at trade shows, is expected to be on the market early next year. Praktisix II (above, right) is the only camera of its type now on the market. It takes 2¼-inch-square pictures, has an automatic *f*/2.8 lens—fast for a 120 camera—and focal-plane shutter. Cost: $300. Eye-level prism (not shown) is $85. It's a handy camera—even if your nose does get a bit squashed.

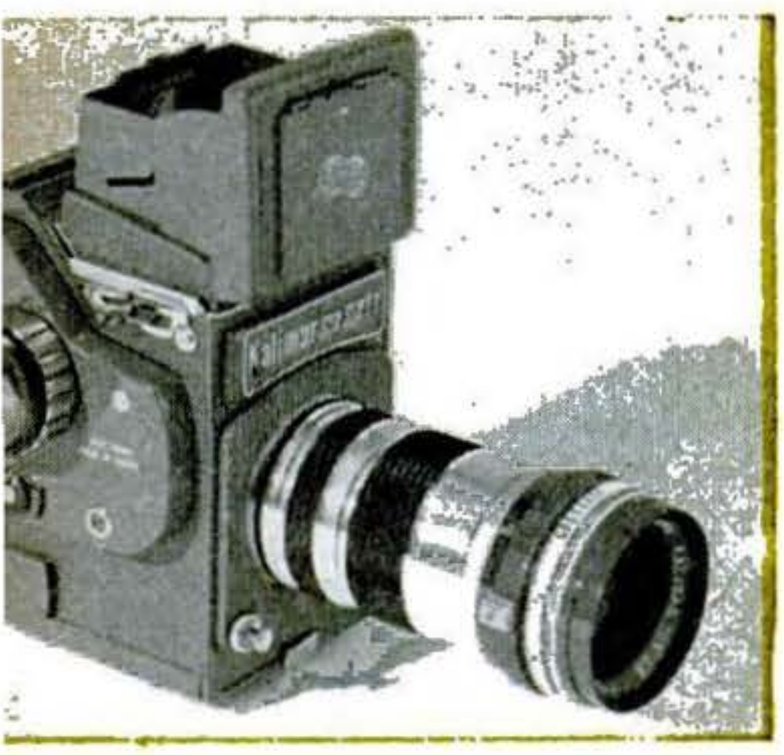
Fine design and workmanship characterize the new 120s



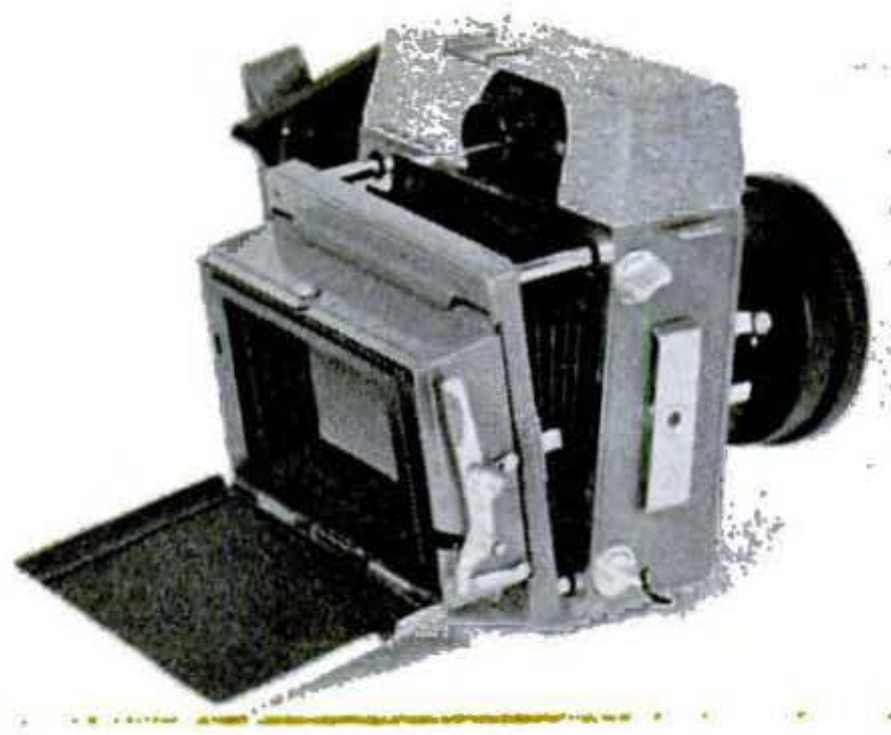
Koni-Omega shoots 2¼-by-2¾ pictures—20 to a roll with 220 back. Ingenious back has fast-action push-pull slide to advance film and cock shutter.



Linhof Press 70 shoots 2¼-by-2¾ format. A superb mechanism, it has a price to match: $745 for body, $510 for 80mm lens, $769 for 53mm lens.



Kalimar Six Sixty, a poor man's Hasselblad, lists for $200 with *f*/2.8 lens. A wide assortment of lenses and accessories is available. Extension tubes shown adapt it for close-ups. Eye-level finder is an option.



Mamiya 23 Deluxe has swing back to increase depth of field in close-ups or correct perspective distortion. Beautifully designed, reasonably priced, it shoots several formats (to 2¼ by 3¼), adapts to any use.

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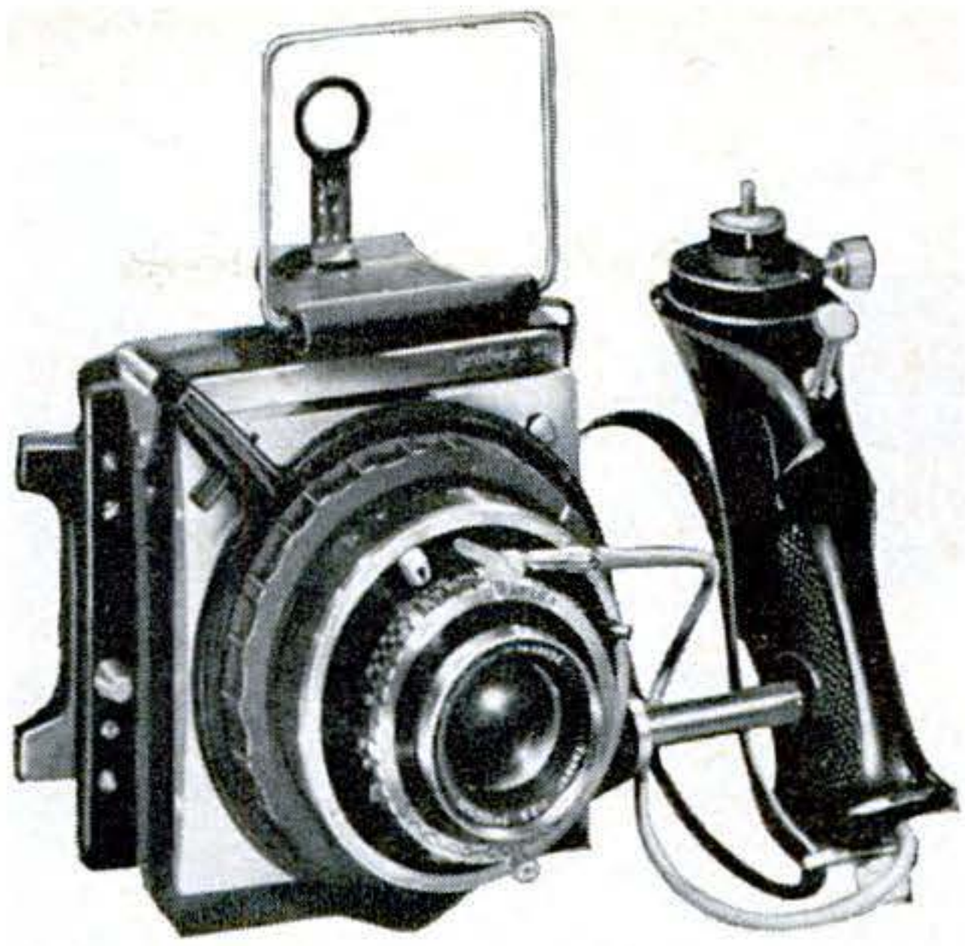
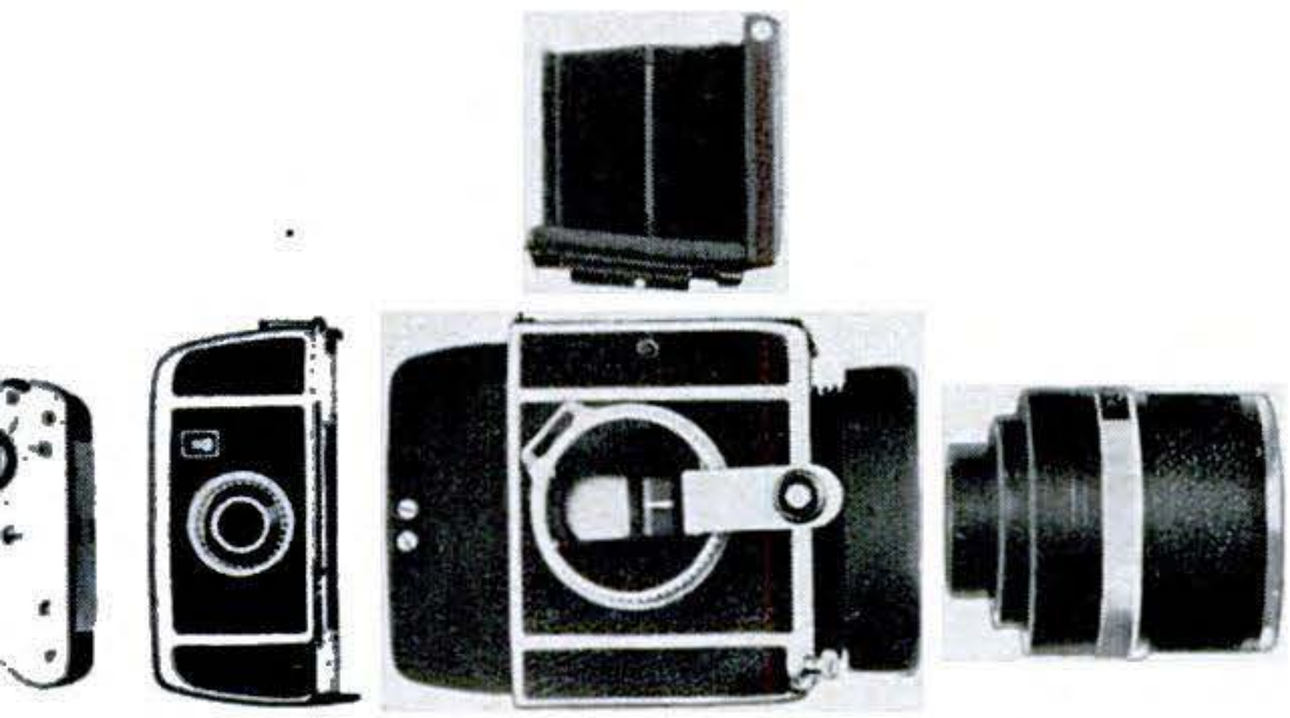
but with the jumbos, you "build" a camera to suit the job

Bronica S2, Hasselblad's big competition, has *f*/2.8 lens, crank for fast shooting, focal-plane shutter, and interchangeable backs.



Graflex XL is a do-everything working photographer's workhorse, good for sports or press use, for weddings or portrait jobs.

Linhof 220 has match-needle exposure system, *f*/3.5 lens. Pushing lever (on the side) advances film and cocks the shutter.



Rollei 66 is the newest entry in the 2¼-square SLR battle. A do-everything camera, it has built-in bellows for close-ups, tiltable lens to increase depth of field. Accessories not yet available but coming: Polaroid back, light meter, prism finder.

tages of 35, plus the extra quality of a larger film size.

Which types are they switching to? At the moment, the single-lens cubes are in: Hasselblad, Bronica, the new Rollei 66. All offer interchangeable lenses and film backs. All can take the new double-length 220 film—with 24 exposures on a roll instead of 12. The disadvantages (compared with 35): slower lenses (*f*/2.8 is the fastest); awkward, hard-to-grip shape; high price.

But a new breed is coming up, one shaped like a 35mm SLR but big enough to take 120-size film. Praktisix was first with this design, but others are scheduled to show up soon. One, the Pentax 220, was displayed recently in prototype. It shoots "ideal" format pictures (2¼-by-2¾ inches, which can be enlarged to 8 by 10 without cropping).

Other manufacturers rumored to be working on 120-size cameras are Mamiya, Canon, Miranda, Minolta, Kowa. Watch for them—or some of them—next year.

Unquestionably, the big 120 fight for the consumer's money will be between the cube and the blown-up 35. Until more cameras of the latter type appear, it will be impossible to predict the winner. But some predictions about the fea-

[Continued on page 213]

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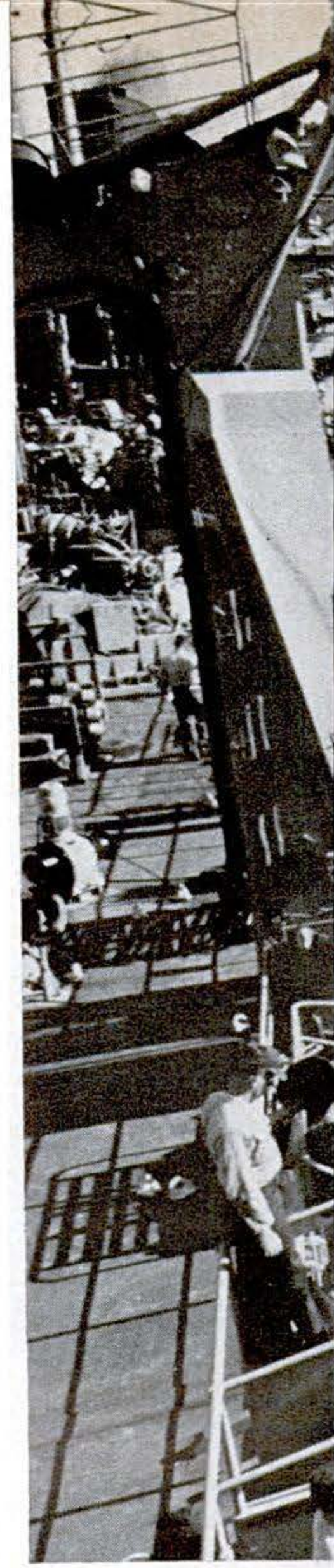
Helicopters permit the Sacramento to service vessels at distances of more than 50 miles. All provisioning and refueling is done with combat ships under way.

Lift trucks prepare ammunition for cargo net. Ship's 600-man crew has deck force of 110 moving 300 tons an hour.

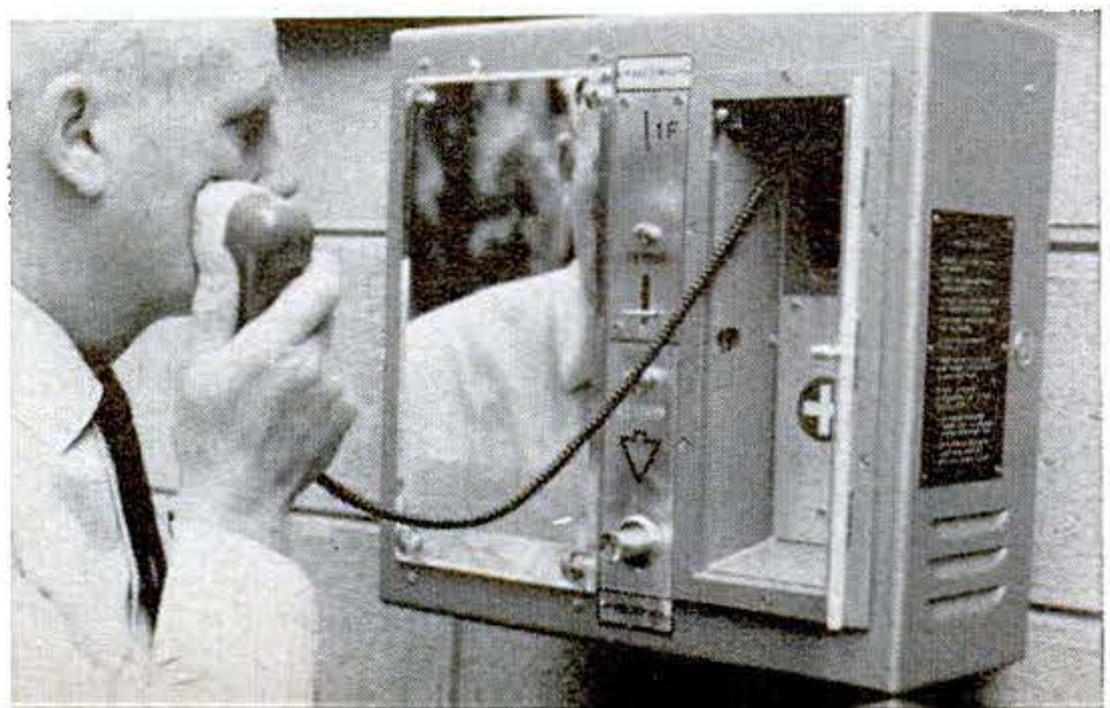
Crewmen position one of huge fuel lines that will begin pumping within nine minutes after "customer" comes alongside.



Sacramento, under

Supermarket on the high seas

A little-known vessel roams the Gulf of Tonkin off the Vietnam coast to help fight the war. It's huge, displacing 53,000 tons. It shoots no guns, dispatches no planes to drop bombs. But the Navy could not do



Did you miss your morning shave?

Relax. If you're in West Germany, just drop a coin in a vending machine, and this happens: A cabinet door opens, an electric shaver switches on, an after-shave lotion cup fills, and warm air blows out to dry your face. There's a hitch, though—you've got to shave in four minutes flat.

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ommand of Skipper James R. Collier, pumps fuel into bunkers of aircraft carrier USS Hornet.

without it. Literally, it's a floating supermarket. The USS Sacramento is a fast combat-support ship, carrying fuel oil, ammunition, and food to the vessels of the Seventh Fleet, large and small. It carries five million gallons of petroleum products, 1,600 tons of ammunition, and 500 tons of refrigerated foods, plus miscellany and mail. These striking photos of its operation were taken by Navy cameraman Robert Moeser.

Parbleu! This is a car?

You can't be any more puzzled than the cyclist who is turning to look at a strange contraption on a Paris street. It's a car. It runs. The inventor says it can "comfortably" accommodate six to eight persons, which may be open to question. It's exactly 10.6 feet high, long, and wide.

The Rifle

By PAUL WAHL

Need a new small-bore rifle? How about a 20-gauge shotgun? You get both in a single package if you buy Savage's new Model 24 over-and-under combination. Incorporating both rifle and shotgun, it has a .222 Remington caliber barrel over a 20-gauge tube. The beginning hunter can learn the techniques of both without a double investment, and the expert has a good combination in a single unit.

After sighting-in the gun with my variable-power rifle scope set at 8X, I fired 10 five-shot groups at 100 yards from a bench rest. The 10 ring of the standard rifle target is two inches in diameter. There wasn't a single group that wouldn't easily fit inside that size circle. This is quite accurate for any light hunting rifle, and unusual for a low-priced combination gun—a type of firearm which in even costly European versions doesn't score high as a rifle.

Before taking it to the rifle range, I put the Savage 24-V through its paces as a shotgun. The under barrel is a fully choked shotgun tube chambered for 20-gauge 2¾- and 3-inch shells. I found that the gun throws good full-choke patterns, did a creditable job on clay birds.

Combining a high-velocity center-fire rifle with a powerful magnum shotgun, the Model 24-V equips you for all kinds of small-game and varmint shooting. You're always ready for either rifle or shotgun targets. And while .222 Remington isn't recommended as a deer caliber, a rifled slug from the shotgun tube can put venison on the table.

Of course, in effect it's a single shot—if you miss a pheasant with the first shot, the rifle cartridge in the second barrel won't do you any good. Some states limit the use of combination guns for hunting. So better check with your game warden on its use.

Savage Arms has been making combination guns since 1935. The original model, marketed under the Stevens brand, was chambered for .22 long rifle and .410 bore. During World War II, the U.S. Army Air Forces used it as a survival gun for air crews. In recent years, Model 24 has been offered in .22 Winchester magnum rimfire and 20 gauge, as well as .22 long rifle and .410.

Safety feature. The hammer is the rebounding type; fires only when the single trigger is pulled. A two-position striker is built into the hammer. To fire the upper barrel, push the spur forward. This can be done as you cock the hammer.

As you swing the barrels open, an extractor draws the cases part way out. There is no ejector.

Unlike other models of the Savage 24 series, which have their barrels brazed together from breech to muzzle, the Model 24-V barrels are fitted into a heavy one-piece breech, held near the muzzles by a band. There is about a ⅛-inch space between the barrels. This system of construction helps account for the accuracy of the 24-V's rifled tube.

The frame, finished in satin black, is engraved with a turkey on one side and a fox on the other. Barrel assembly has a highly polished blued finish.

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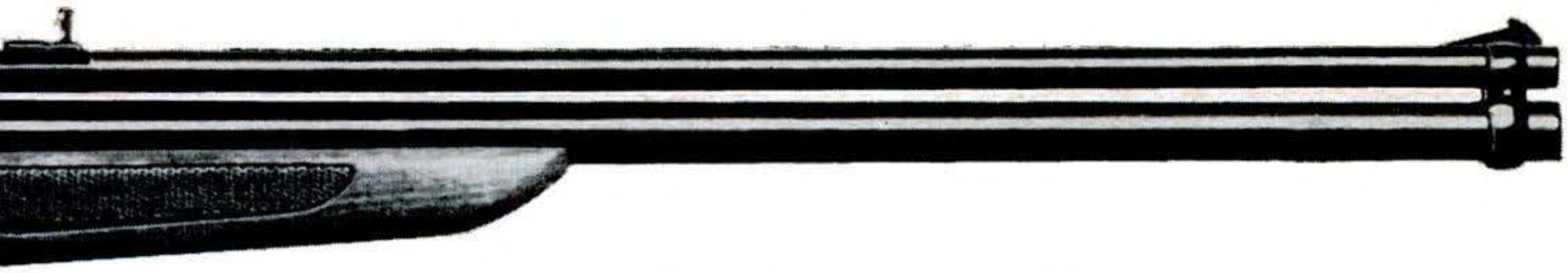
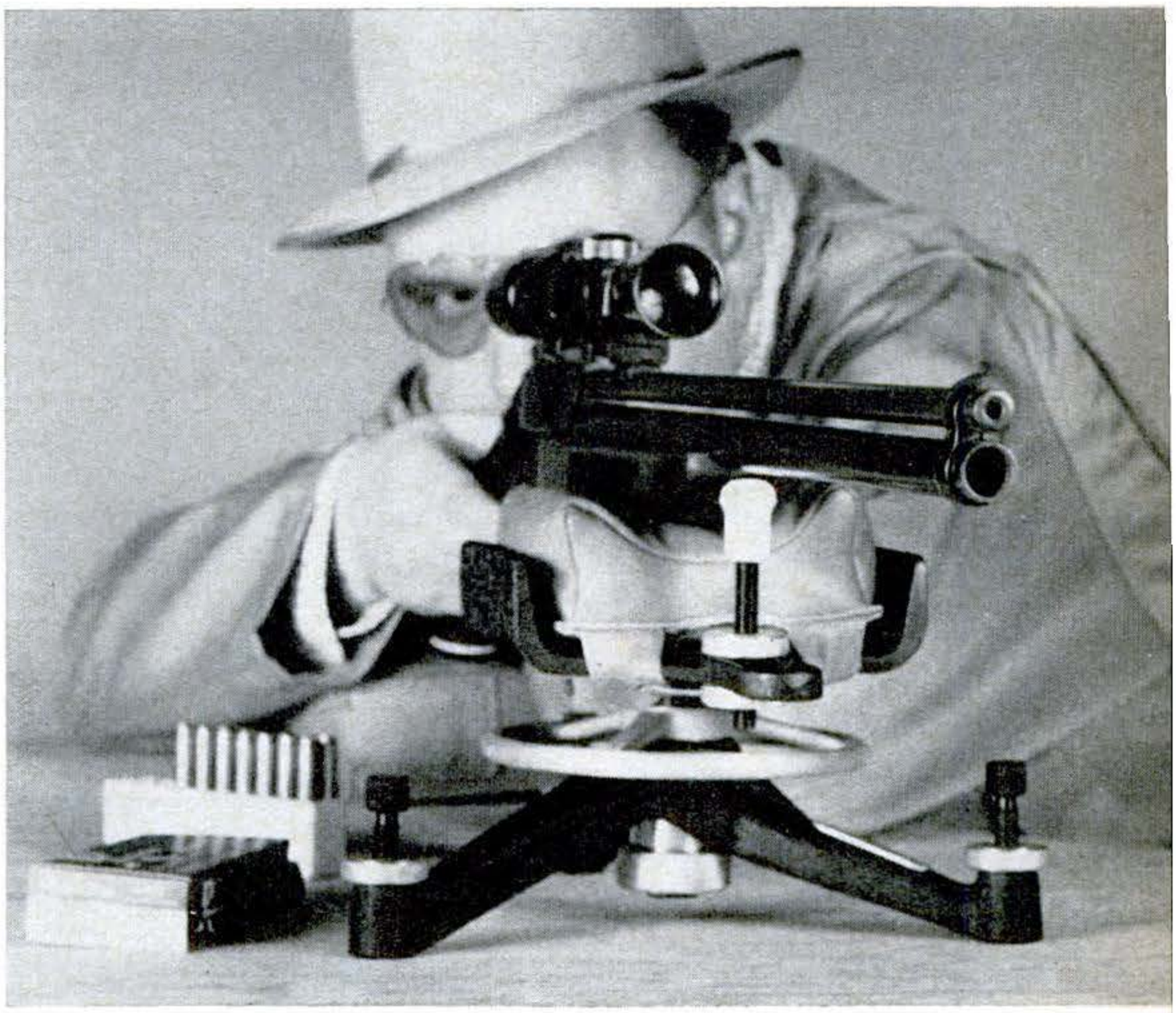


This attractive new Model 24-V Savage offers you two-way versatility in one lightweight firearm

That's Also a Shotgun

New Savage over-and-under gun s built on traditional top-break lesign of single-barrel shotguns. To open breech, push top lever to either side—a feature southpaws ike. This unbolts action and allows barrels to be pivoted open.



Author test-fires the .222 Remington rifle of new combo gun after sighting with a variable-power scope. He found it extremely accurate. At 100 yards 10 five-shot groups all hit inside the two-inch-diameter 10 ring.

The rear sight is a Lyman adjustable folding leaf mounted on a base attached to the rifle barrel. Up front, there's a ramp with integral gold-faced blade. Breech and rear-sight base are drilled and tapped for a top-mounted scope. To take advantage of the long-range potential of this gun's .222 Remington caliber rifle barrel, it should be equipped with a good scope. A 4X should do nicely.

The Monte Carlo-style stock of black walnut is attractively checkered, fitted with a white-line butt plate and pistol-grip cap; length of pull is 14 inches. The fore end is checkered for a sure grip.

Adding to the attractiveness for campers and woodsmen is an easy takedown: Grasp tip of fore end and pull it away from the barrels; open breech and unhook barrel lug from hinge pin; close breech, attach fore-end spring in spring lug, and press fore end against barrels.

The Savage 24-V has 24-inch barrels, measures 40 inches overall, and weighs 6¾ pounds.

If you're looking for an all-purpose hunting rifle, this combo is it. The price is reasonable, too—$79.50.

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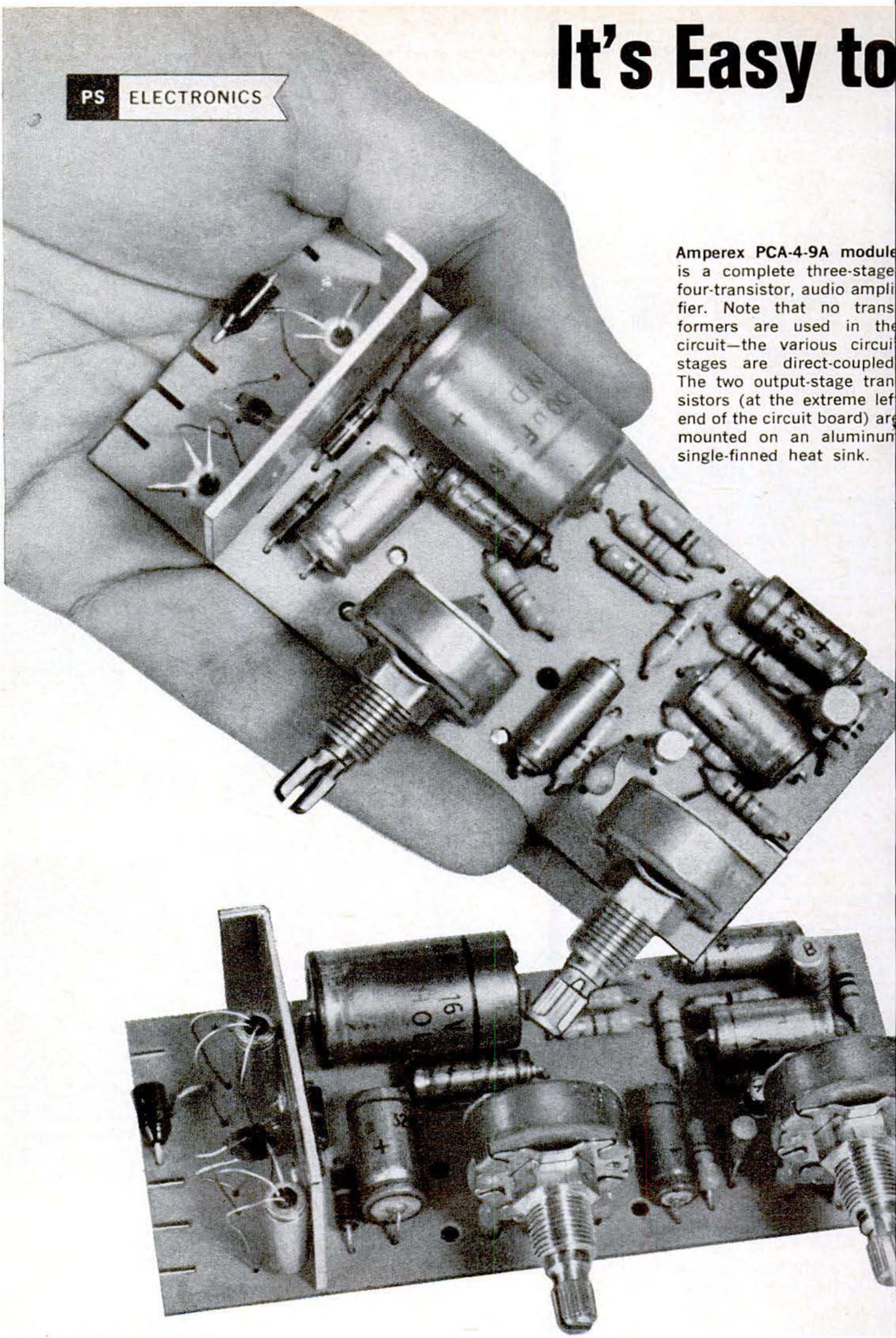
It's Easy to



Amperex PCA-4-9A module is a complete three-stage four-transistor, audio amplifier. Note that no transformers are used in the circuit—the various circuit stages are direct-coupled. The two output-stage transistors (at the extreme left end of the circuit board) are mounted on an aluminum single-finned heat sink.

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Build Electronic Projects with Prewired Modules

Put these ready-to-connect high-gain amplifier modules to work for you. Here's how

By RONALD M. BENREY
PS Electronics Editor

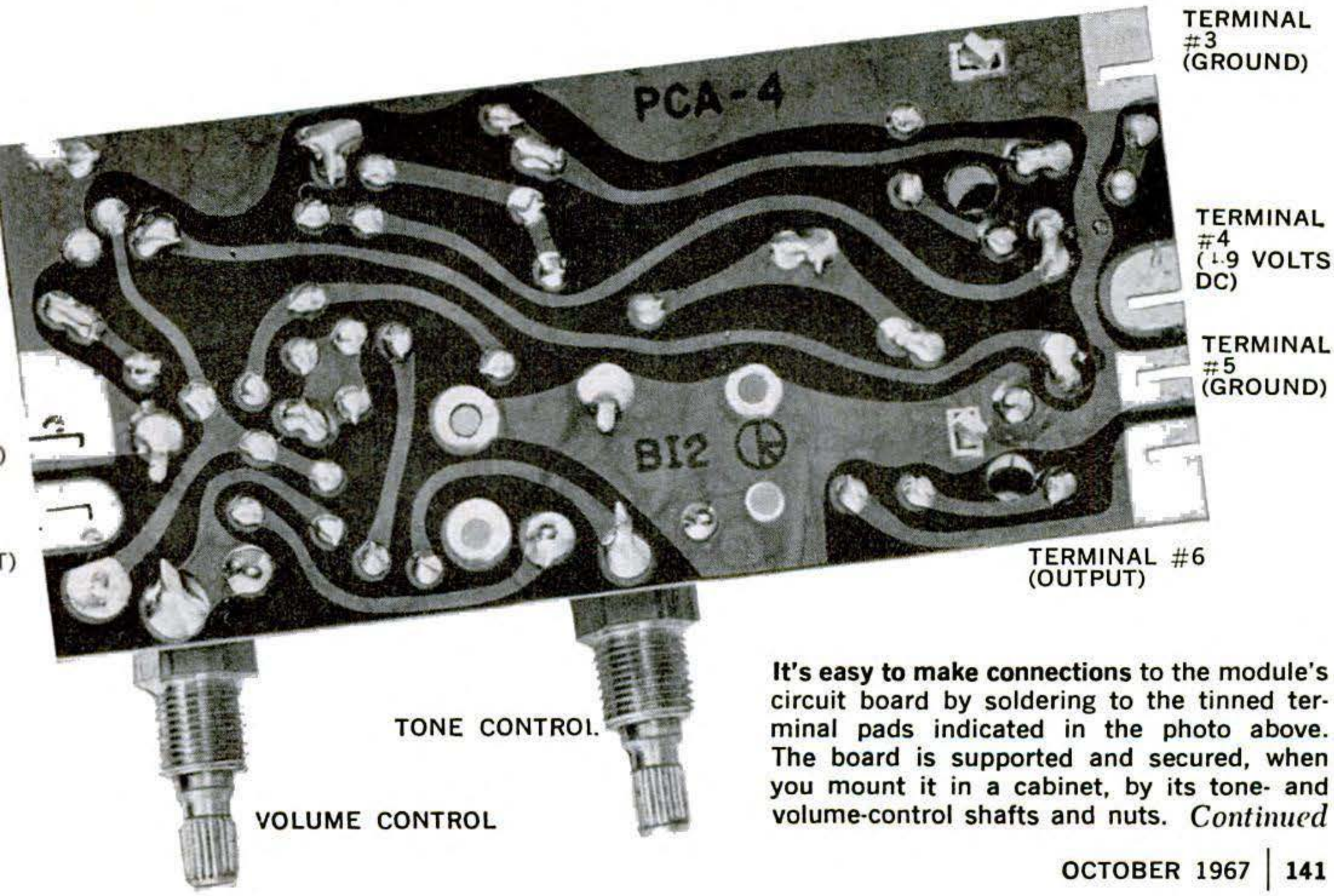
Why begin from scratch when you build electronic projects? The prewired modules shown on these pages give you a whopping head start. Each module is a one-watt high-gain audio amplifier, complete with preamplifier stage, volume and tone controls. Just add a few components and a power source, mount them in a suitable cabinet, and you've got a functioning electronic device.

What can you do with them? The four projects described on the next two pages will set your mind working. We've given you a pictorial wiring diagram for each.

Because of a clever circuit design that includes a built-in rectifier and filter capacitor, the modules can be powered by either a nine-volt DC battery or a 6.3-volt AC transformer that is plugged into any 120-volt AC outlet.

Choose a hefty nine-volt battery, since current drain is substantial at full power output. The battery's positive terminal must go to terminal #4 (see diagram below). A suitable transformer is a Stancor P 6465 (or equivalent) 120-volt to 6.3-volt (at .6 amp) unit. Connect the 6.3-volt AC leads (usually green) between terminals #3 and #4 instead of the battery and switch as shown in the diagrams on the following pages. Wire the 120-volt AC leads (normally black) to a line cord and AC power switch.

The modules cost about $9 each and are made by the Amperex Electronic Corp., Hicksville, N.Y. 11802.



It's easy to make connections to the module's circuit board by soldering to the tinned terminal pads indicated in the photo above. The board is supported and secured, when you mount it in a cabinet, by its tone- and volume-control shafts and nuts. *Continued*

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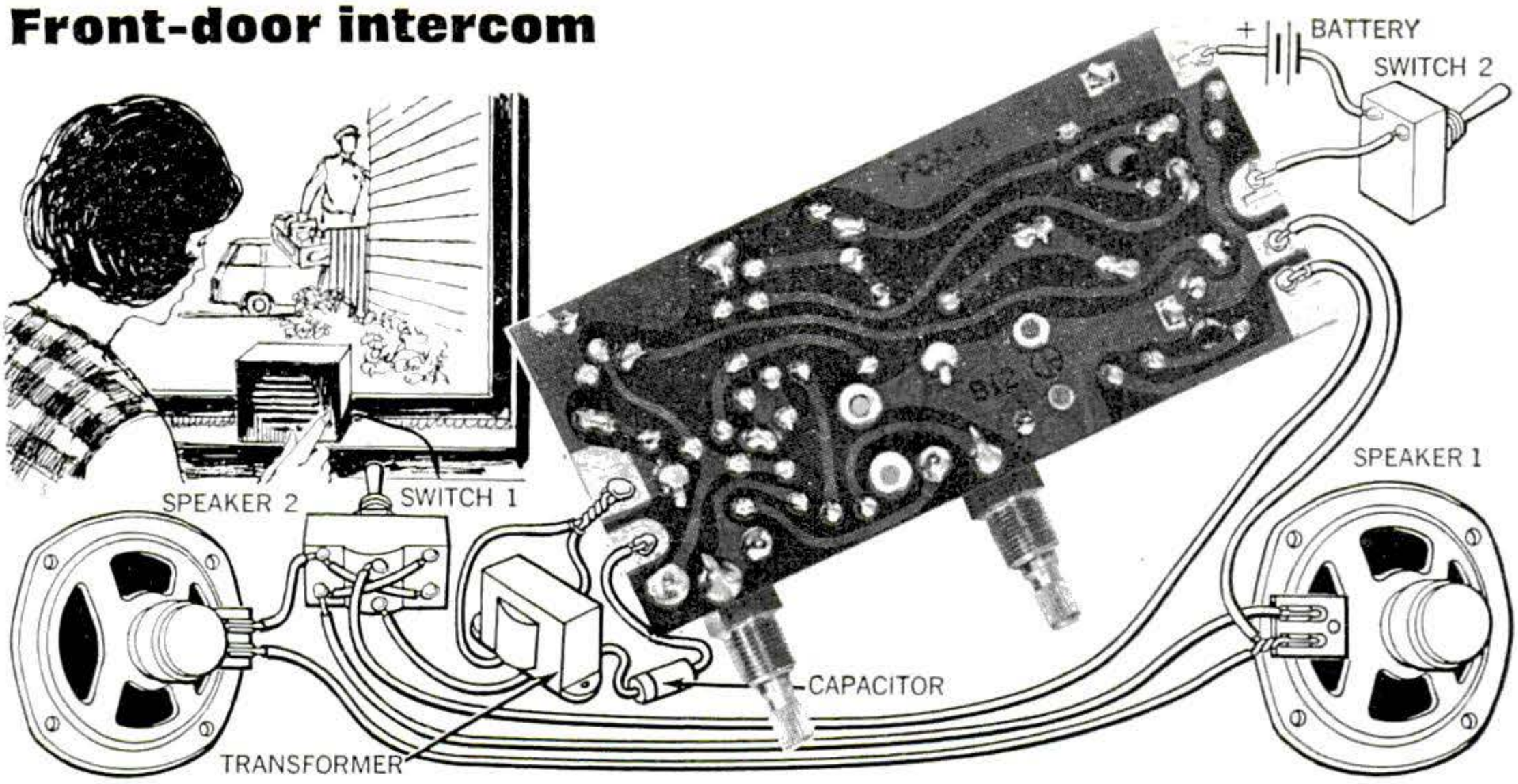
Front-door intercom

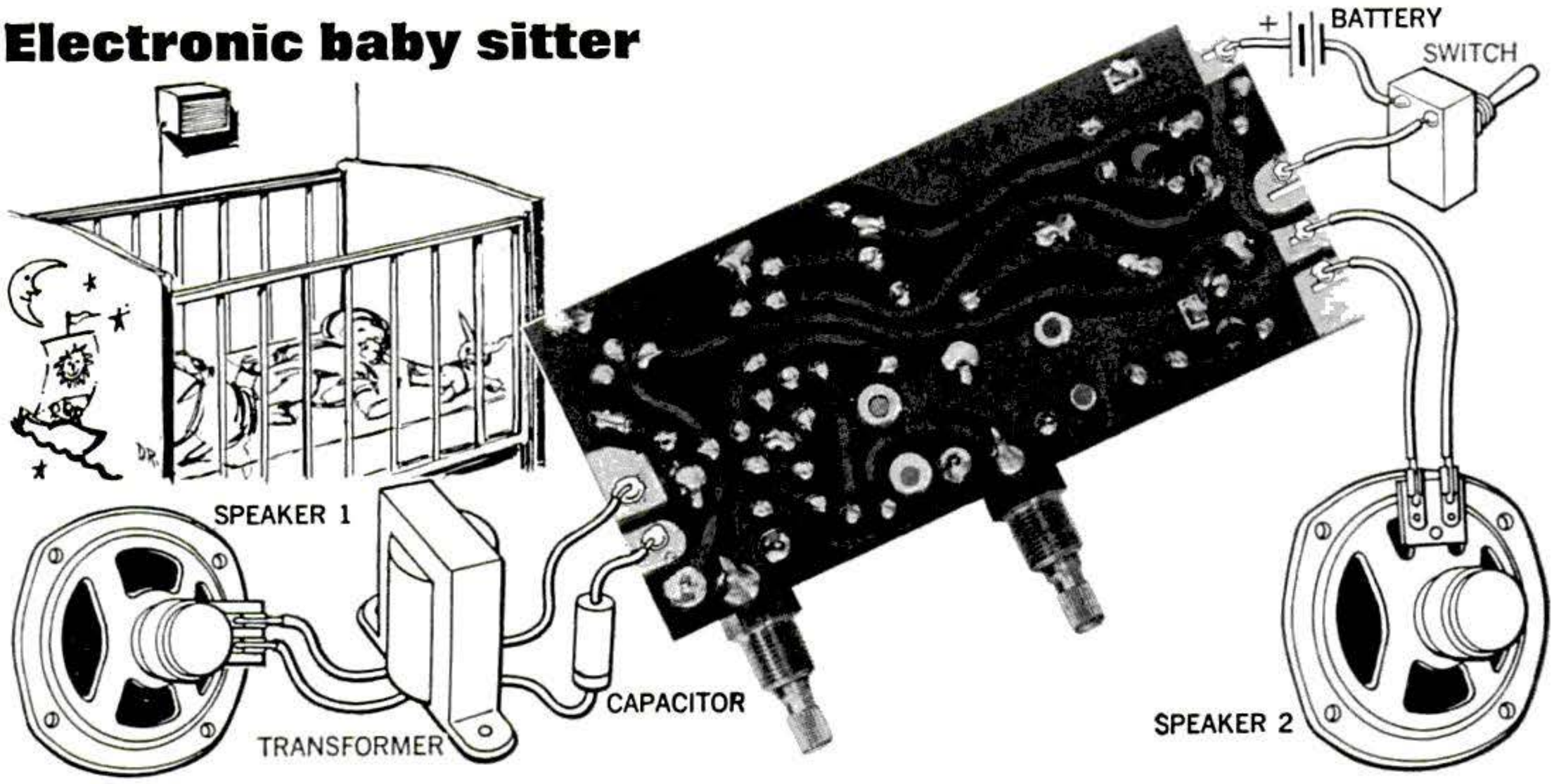


This intercom circuit uses loudspeakers that are also pressed into service as dynamic microphones. Speaker 1 is inside the intercom's cabinet along with the amplifier module; speaker 2 goes next to the door, inside a weathertight enclosure.

When talk-listen switch S1 is flipped to the "listen" position (left position, in diagram) sounds picked up by speaker 2 are amplified and reproduced by speaker 1. With S1 in the "talk" position (right position in diagram), their functions are reversed.

Note: See text below for details on wiring transformer and capacitor into the circuit. *Parts:* Audio output transformer (10,000-ohm primary to 8-ohm secondary); 10-mfd., 10-volt electrolytic capacitor; DPDT toggle switch (S1); SPST toggle switch (S2); two speakers.

Electronic baby sitter



This is a one-way intercom. Sounds picked up by speaker 1 (mounted in a baffle in a baby's room) are amplified by the module and reproduced by speaker 2 (mounted in the main cabinet along with the other components).

The transformer couples the low-impedance speaker to the high-impedance amplifier input. Connect its 10,000-ohm winding leads to the capacitor and module, as shown. The low-impedance (8-ohm) winding leads go to the speaker (or switch 1 in the door-answerer circuit above). Be sure you connect the banded (or positive) end of the capacitor as indicated in the diagrams.

Parts: Audio output transformer (10,000-ohm primary to 8-ohm secondary); 10-mfd., 10-volt electrolytic capacitor; SPST toggle switch; two 8-ohm loudspeakers.

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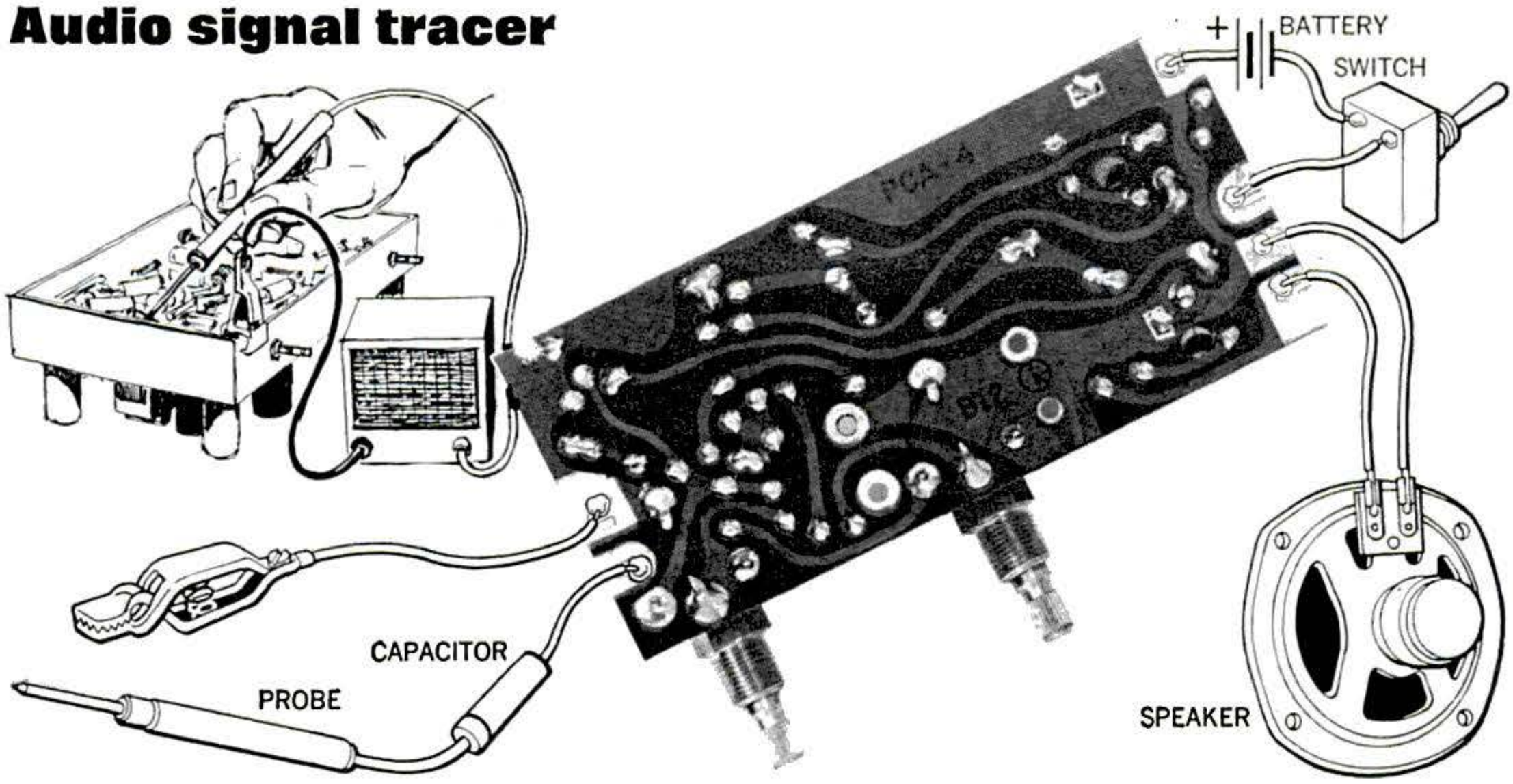
Audio signal tracer

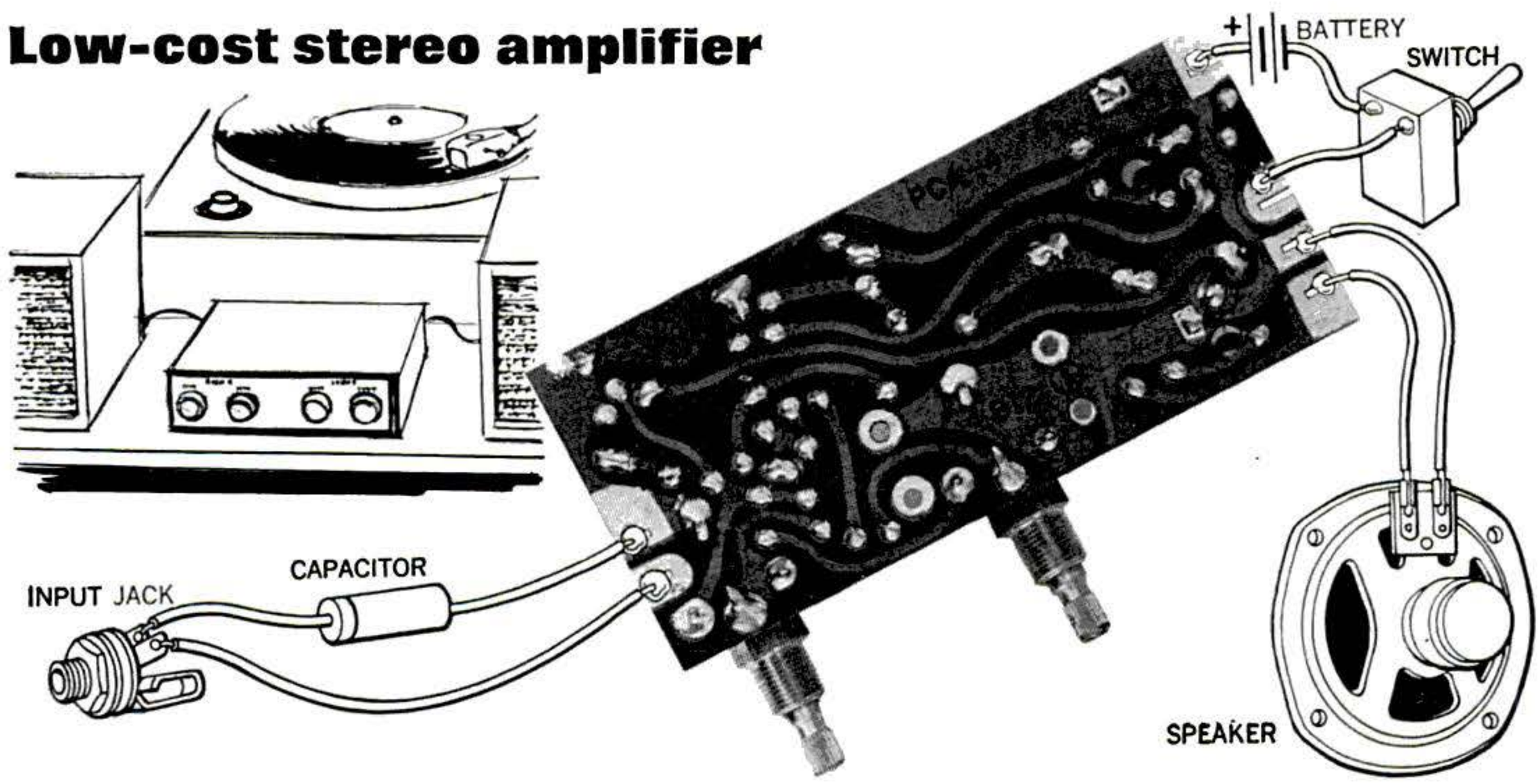


Here's a gadget you can use to service solid-state audio gear. It's basically an audio amplifier hooked to a probe—you use it by first connecting the alligator-clip-equipped ground lead to a ground point on the unit you're servicing, and then tracing the progress of an audio signal by touching the probe to component leads in the various stages. You begin with the input stage, and listen to the tracer's loudspeaker for the tone. As you go from stage to stage, the tone you hear should get louder. When the sound disappears, start looking for a bad component.

Note: Do not use this device to trouble-shoot vacuum-tube gear; the high signal voltages involved will damage its components.

Parts: 8-ohm loudspeaker; 10-mfd., 10-volt electrolytic capacitor; SPST toggle switch.

Low-cost stereo amplifier



You won't find a stereo set any simpler than this, and although its fidelity isn't the highest, it makes a handy second system that's ideal for the kids: Just plug in a record changer. The diagram shows only one of the two sound channels; the other is identical. Incidentally, the speaker pictured can be either a small 8-ohm permanent-magnet unit (like those used in the other projects) mounted in a suitable enclosure, or a conventional high-efficiency-type hi-fi speaker. (Note: This amplifier is not powerful enough to drive acoustic-suspension speakers.)

Because of the amplifier's limited sensitivity, you must install a high-output ceramic or crystal cartridge in the changer's tone arm.

Parts: Phone jack; 10-mfd., 10-volt electrolytic capacitor; toggle switch; speaker. PS

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You can build this

Superspeed Recharger for Nickel-Cadmium Cells

Forget about overnight recharging of ni-cad cells. This charger fills 'em up in minutes. Here's how to build one

By **RONALD M. BENREY** / *PS Electronics Editor*

Here's the next best thing to owning your own flashlight-battery factory—a superspeed nickel-cadmium battery recharger. Team this gadget up with a supply of those new rechargeable ni-cad cells, D size (see parts list), and your dry-cell-buying days are over.

Ni-cad battery chargers aren't new—but you've never seen one like this before. It will quick-charge a medium-capacity D-size ni-cad cell in just over 20 minutes. High-capacity cells take under an hour.

Before this, ni-cad chargers took several hours—often overnight—to replace a full charge. The secret of this unit's speed is a dual-current circuit that first pumps a high recharge current into the cell and then throttles down, automatically, to a safe trickle-charge current when it decides the cell is about 85 percent full. This automatic current-limiting action is necessary since maintaining the high-speed current level could damage the cells irreparably once they were fully charged.

The superspeed charging technique has one penalty, though: You can charge only one cell at a time. The reason: The units measuring circuitry can only judge the degree of charge in a single cell. This isn't much of a handicap, though, since you can still charge a box full of ni-cad cells—one at a time—a lot faster with this charger than with any overnight-type unit.

How it works. Heart of the automatic operation circuit is the meter relay (labeled "Relay" in diagrams). This device looks and functions much like a sensitive DC milliammeter, except that its "needle," instead of moving across a visible scale, closes a circuit whenever the current flowing through the device reaches a certain level.

The meter relay is wired in series with a resistance (R4 + R5) to create a voltage-reading relay. This constantly monitors the voltage of the cell under charge. When the cell voltage reaches a specific value—1.25 volts, which corresponds to about an 85-percent full charge—the relay closes and switches off the high-charge-current circuitry.

The charge circuit, itself, is unusual: It uses a silicon-controlled rectifier (SCR) to convert the low-voltage AC supplied by the transformer into a high-amperage DC to charge the cell.

During high-current charge conditions, the SCR functions much like a conventional rectifier. When the meter relay decides the cell is nearly full, its contacts turn off the high-current circuit, by shortening the SCR's gate terminal to the cathode terminal. This effectively turns the SCR into an open circuit. Then

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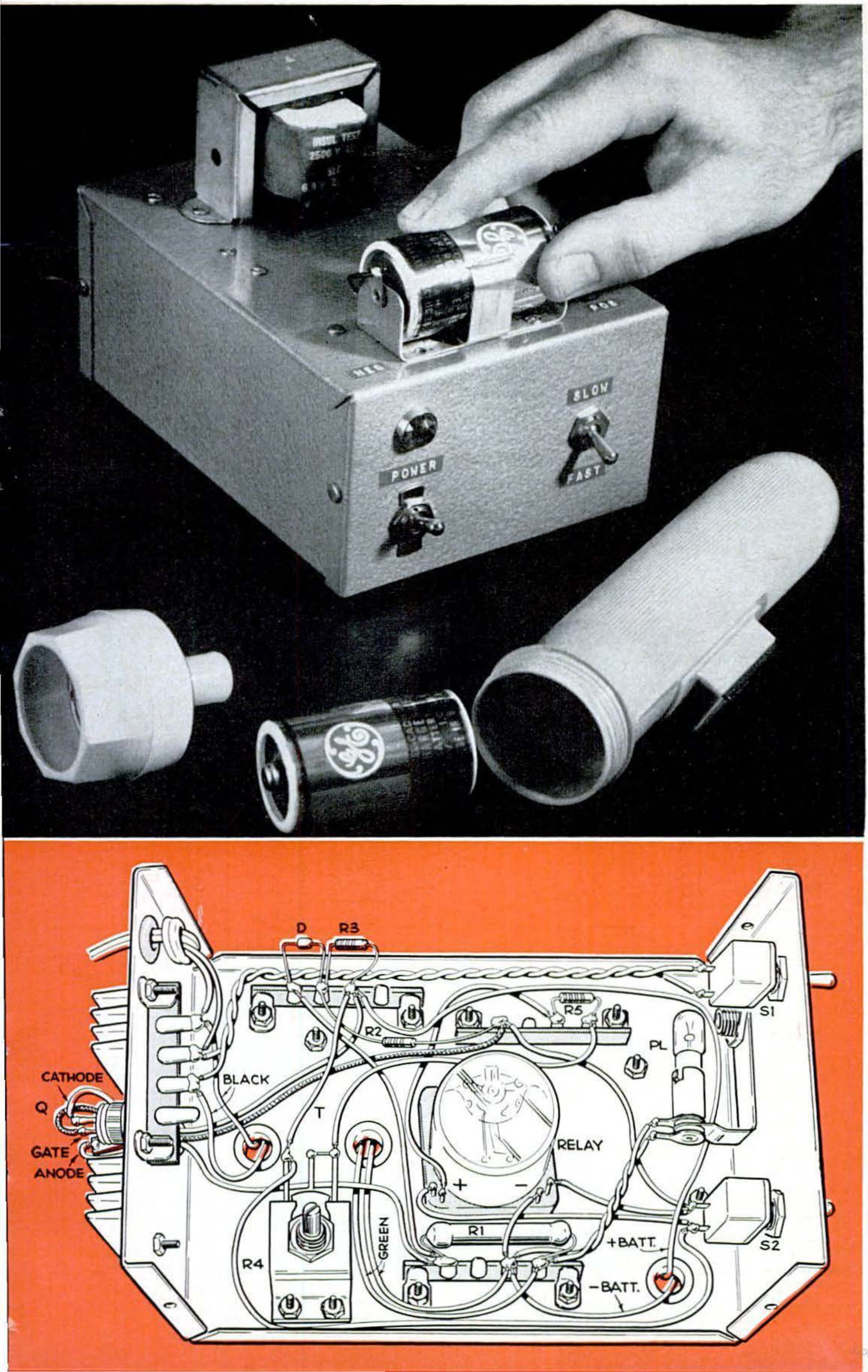

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the cell is trickle-charged by a low-amperage DC produced by diode D.

Note: Switch S2, wired in parallel with the relay's contacts, gives you manual control over this action so you can use the unit as a trickle charger any time you wish—just flip S2 to its "slow charge" (switch-closed) position.

It's a good idea to trickle-charge, rather than fast-charge, a battery if you have the time. The reason is that high-current charging may reduce a ni-cad cell's life slightly.

Building it. Use a 7"-by-5"-by-3" aluminum minibox as a chassis. Mount the transformer, battery holder, and heat sink for the SCR on the outside, as shown.

Use the mounting kit provided with the SCR—the mica and nylon washers must insulate the body from the heat sink.

Mount four four-point terminal strips inside the minibox to serve as soldering and mounting points for the other components. Double-check the polarity of the diode leads, and the wires running to the meter relay's coil terminals, before you solder them in place.

Use a small-tipped soldering iron, and work quickly when you solder to the small terminal pins on the meter relay: Too much heat may make them fall out.

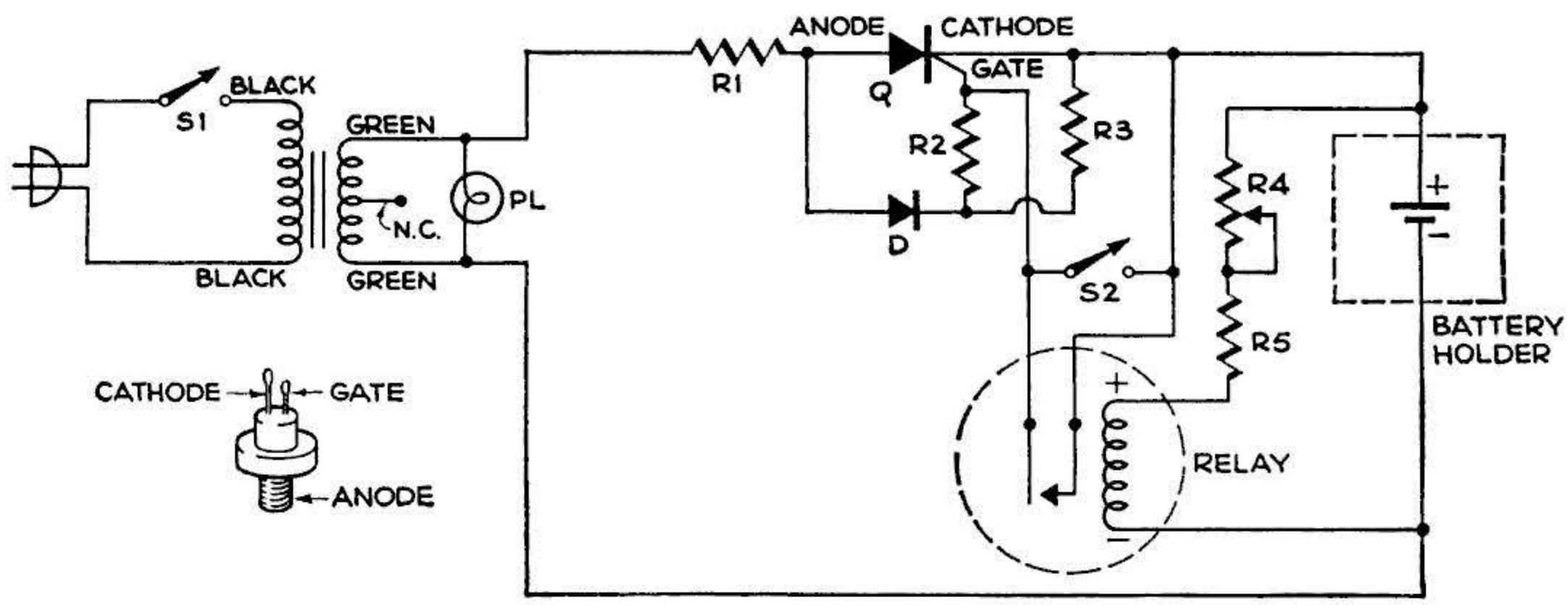
Also, grip the leads of diode D with a pair of long-nose pliers as you solder. The pliers act as a heat sink, and prevent the diode from overheating.

Although the SCR is mounted on a heat sink, and is designed to dissipate heat rapidly, try not to overheat it when you make connections to its gate and cathode terminal pins.

Resistor R1 is a power resistor, and will get very warm to the touch when the charger is supplying fast-charge-rate current. Mount it by its leads, as shown, and position its body up in the air, well away from other components.

Calibration. To adjust the automatic switchover circuit, place a discharged ni-cad cell in the holder, and set S2 to its slow-charge (switch-closed) position. Turn the power on and let the trickle charger go to work. Periodically measure the cell's voltage (with a low-range DC voltmeter). When the voltage is exactly 1.25 volts, turn off the power switch and adjust R4 until you can see the relay needle just closing the built-in contacts—the action is visible through the unit's clear-plastic top.

Using it. Nickel-cadmium batteries are safe and reliable devices. However, to guard against the remote possibility that a cell might burst while being recharged, we suggest that you fashion a cover of plastic or wood that slips over the cell when it is in the holder. PS



PARTS LIST

R1—2-ohm, 10-watt power resistor
R2—220-ohm, ½-watt carbon resistor
R3—68-ohm, ½-watt carbon resistor
R4—500-ohm carbon potentiometer
R5—100-ohm, ½-watt carbon resistor
Q—GE X-1 SCR
D—International Rectifier 10D4 silicon rectifier
T—6.3-volt AC (@ 3-amp) Stancor P-6466 or equivalent
Relay—Meter relay, Lafayette Radio #99 C 6199
S1, S2—SPST toggle switch
Misc: Battery holder for size D cells; aluminum minibox; 6-volt pilot lamp and holder; heat sink; line cord; hardware
Note: The moderate-capacity D-size nickel-cadmium cells mentioned in the text are manufactured by the General Electric Co., Gainesville, Fla. They cost under $2.50. Higher capacity—and consequently more expensive—cells are sold by most electronic-supply houses.

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This month's question for the Ask-Our-Computer service

How Effective Is the Insulation in My Home?

Does poor insulation cost you extra money every winter? To find out, ask our computer

Ever get the feeling that a lot of your hard-earned cash is going up in smoke—in the form of wasted heat that your home's insulation is letting slip by? You could be right. Now there's an easy way to double-check.

We've written a new program for the PS computer that will estimate the effectiveness of your home's insulation.

Send us a stamped, self-addressed envelope, and we'll mail you a questionnaire that asks for several pieces of information about your home, including how much you paid for heating fuel last year, and at what temperature setting you keep your thermostat. Complete the questionnaire and return it to us along with a $2 service charge.

Back at the computer, our operators will feed the data you supply into the machine. The program uses your past fuel bill to calculate how much heat in BTUs you actually bought. Then, it compares this with an estimate of the amount of heat a well-insulated house the size of yours in your area should need. If the difference is substantial, there's a good chance your home's insulation is wasting your money.

How much? To find out, the program works backwards: It estimates the fuel savings you'd realize each year if you substantially improved the insulation. This figure will give you a good idea of whether or not the cost of modification (which your local contractor can supply) makes sense.

You'll receive the actual answer sheet produced by the computer, containing these estimates, along with a data sheet that explains how to interpret them.

Send your stamped self-addressed envelope (legal size) to Ask-Our-Computer, Program #5, POPULAR SCIENCE, 355 Lexington Ave., NYC 10017.

If *you* have any suggestions for problems that would make suitable Ask-Our-Computer programs, write them on a postcard, and send them to Ronald M. Benrey, Electronics Editor.

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New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMOI

Landing pad dropped by plane. A helicopter or V/STOL aircraft could turn almost any flat space into a suitable small landing area with the help of this recent Air Force invention. A tough plastic sheet, suspended baglike from a ring beneath the plane, would be pumped full of a fluid plastic and a curing catalyst. When the bag was dropped, the paving mix would flow out to cover the sheet and would set up quickly into a solid surface.

Replaceable pads apply paint. Foam plastic, says this inventor, makes a better paint applicator than a cheap bristle brush, and in this holder it would cost much less to use and throw away. The disposable "bristles" could be cut from standard sheets of foam padding, or from specially tapered strips. A metal or plastic slide would lock the toothed, hinged jaws of the handle around the pad.

Magnets keep pictures straight. Pictures, mirrors, and the like would hang straight and stay that way if they were stabilized by these magnetic aligners. An adhesive-backed tab would secure two hinged, telescoping, disk-ended rods to the back of the picture. Two adhesive-backed chips of magnetic material would be stuck to the wall; the disks would be extended to grip the magnets.

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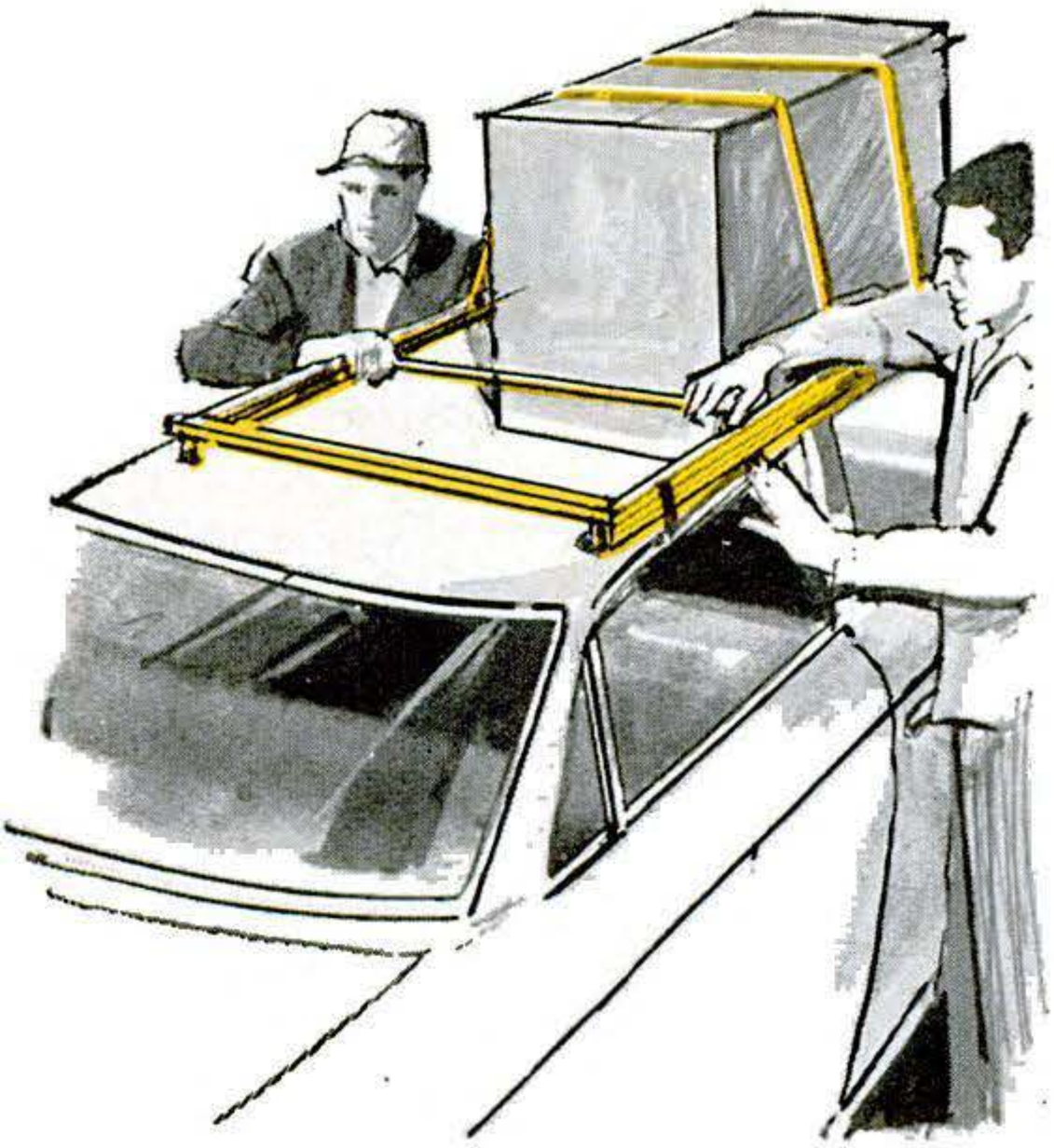
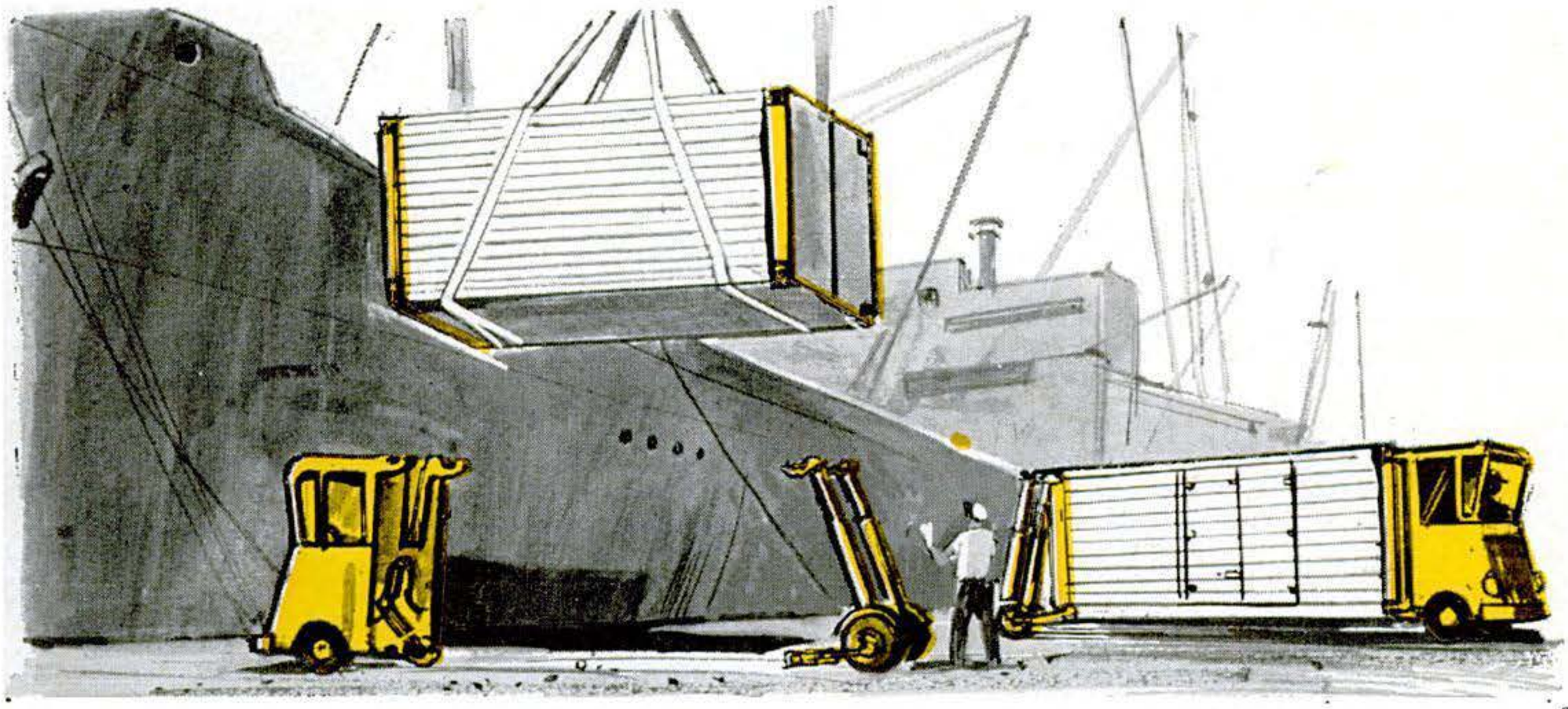


Carrier slides lock car-top load. A bulky load might ride more safely on top of a car if it were kept from shifting by a slide-arm carrier like this. The ends of the crossarms would slide in channels in the longitudinal rails; they could be moved to secure the load, then screw-locked. Eyelets sliding in the rails would simplify tie-down.

Double window encloses blind. An accordion-pleated or roll-up blind between the panes of an insulated, double-glazed window might provide light or privacy as desired, but would take no extra space. Magnets moving up and down in the channels would raise or lower the magnet-tipped ends of the blind. The magnets could be cranked by hand or motor.



Truck wheels hook onto cargo. Containerized cargo might be moved more easily around shipping areas—or delivered to nearby destinations—with this come-apart truck. Driven front wheels and separate rear wheels would grip the cargo containers at top and bottom, front and back. Jacking arms at ends would lift the cargo onto the wheels.

The following patents have been issued on these inventions: **Landing pad**—*No. 3,318,556 to A. Vasiloff and W. Roquemore, Dayton, Ohio;* **Paintbrush**—*No. 3,215,-263 to R. Mathison, Asheville, N.C.;* **Picture straightener**—*No. 3,241,796 to R. and F. Asher, Sterling, Colo.;* **Luggage rack**—*No. 3,253,755 to J. Bott, Grosse Pointe Shores, Mich.;* **Blind**—*No. 3,253,644 to K. Gotoh, Tokyo, Japan;* **Come-apart truck**—*No. 3,253,668 to K. Tantlinger, Grosse Pointe Shores, Mich.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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Al Lindsley, new PS Outdoor Power Equipment Editor, is shown here cutting up a storm-felled tree at his Wisconsin home. He's using a Homelite XL-12, one of the chain saws he tested in preparing to write this article. An engineer with long practical experience with all kinds of machinery, Al takes pride in making all his own repairs around his home. Says he: "If it's mechanical, I'll figure it out."

Your Guide

Weekend woodcutters ar

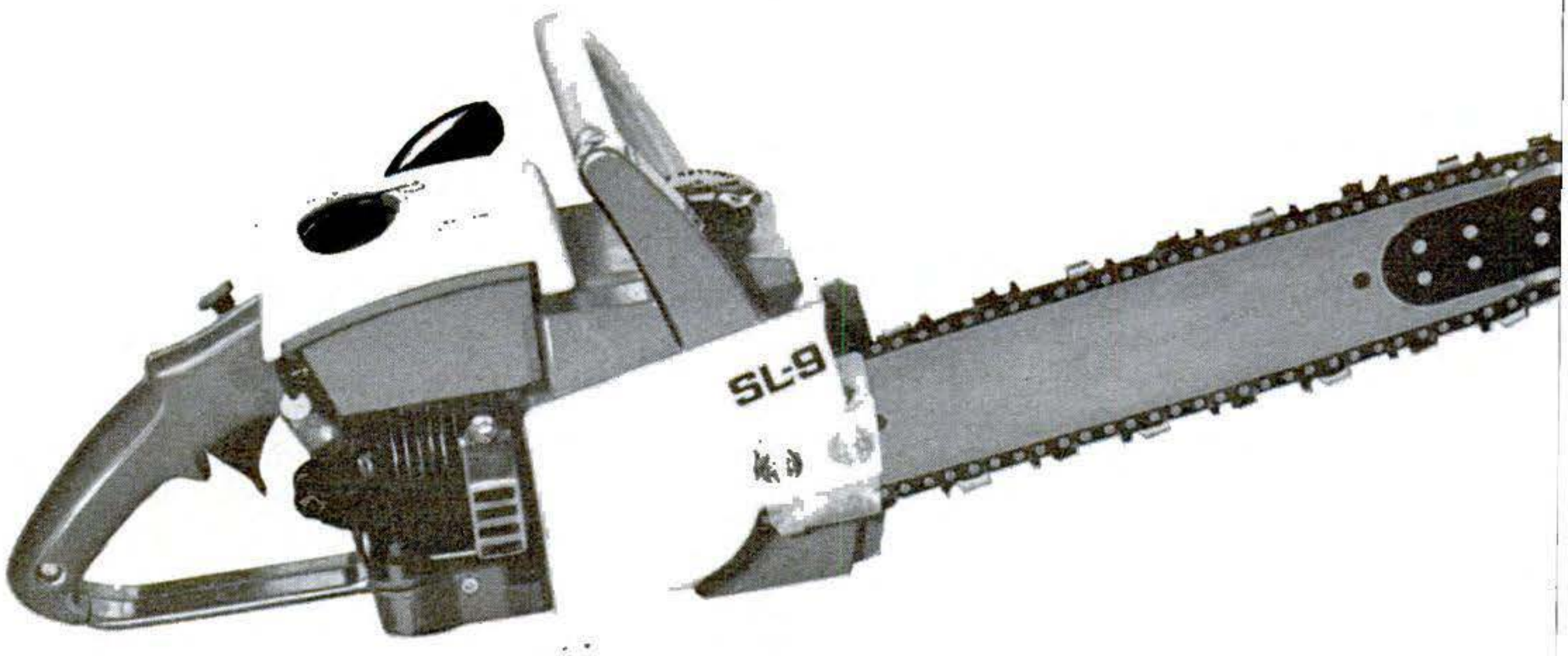
By E. F. LINDSLEY
PS Outdoor Power Equipment Editor

Bright new lightweights with practical price tags are the big story today in chain saws. Home owners, campers, farmers, even apartment dwellers are buying them by the thousands.

"More than 60 percent of our chain-saw sales are now to nonprofessional users." That was Bill Burkett talking. He's vice president of engineering for McCulloch.

McCulloch is one of the big chain-saw makers. There are a small number of others—Homelite, Pioneer (a division of Outboard Marine), Remington Arms, Lombard, Beaird-Poulan, Lancaster, Sears,

The Two Champion Lightweights.....



Lightest of all the small chain saws that have come on the market in recent years is Remington's Power-Lite SL-9. It weighs nine pounds, without bar and chain. A roller nose reduces wear and friction. Next

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o Buying a Chain Saw

nding that this is now an important tool to own

and Montgomery Ward. Several of these make saws under other names for chain stores and other retailers.

In addition, a number of makers sell in a limited area. In recent years, many companies have come and gone. A good rule, therefore: Buy a name-brand product from a manufacturer of long-standing reputation. Also important: a branch or a dealership within easy hail.

What should you look for? Look for what *you* need. Few occasional users need high-cost features of a professional lumbering saw. Neither does a weekend firewood cutter ordinarily need a geared saw. Such a saw could wear out the muscles of most suburbanites in short order. The important things are easy starting, smooth running in any position, reasonably light weight, a chain-bar length for your job, and basic quality.

Quality starts with the engine. Are the crankshaft and rod cast or forged? Does the rod run on its own metal, on a bushing, or on antifriction bearings? What about the main bearings and thrust bearings? Top-quality saws have antifriction needle, ball, or roller bearings, forged rods and crankshafts, and one or two antifriction thrust bearings.

Top-grade saws are usually rated several thousand r.p.m. higher than their lower-rank counterparts. This doesn't mean, however, that the occasional user can't buy a low-priced saw (say for less than $100) that will do all he wants it to do. But the cutting rate in tough going might be slower and overall life will be less. One maker of a low-priced saw mentions 200 hours as its approximate life. That many hours of sawing is a lot for once-in-awhile pruning and cutting.

The cutter bar is also a valuable quality item. One maker describes his low-priced bar as heat-treated tool steel, his higher-grade bar as tool steel with a welded-on armor nose of Stellite to resist wear at this concentration point, and his top-grade chain bar as roller-nosed (important, many makers claim, on high-speed saws).

Don't worry about cylinder bore. Some makers stress the advantages of a cast-

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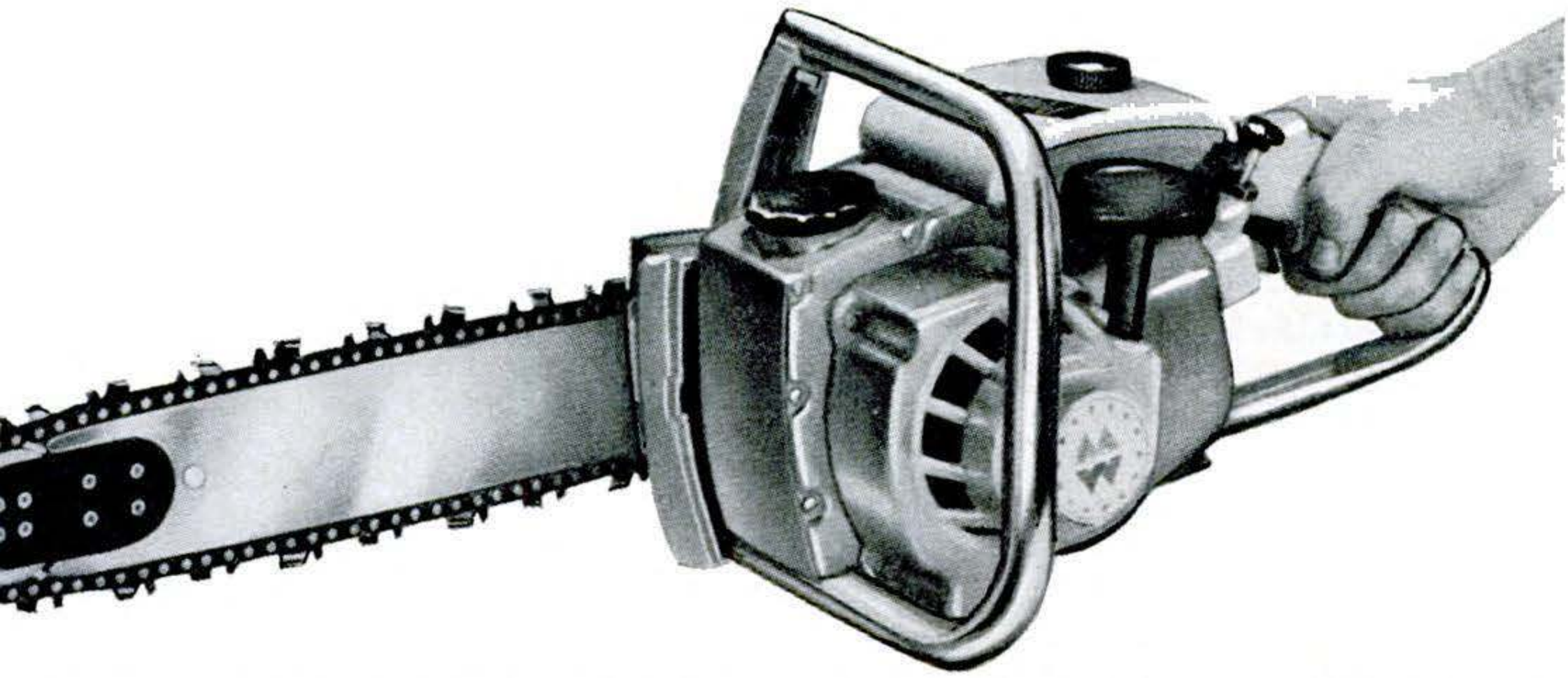

in line in the lightweight class is Montgomery Ward's new saw, above. Its weight, without bar and chain, is 9½ pounds. Both of these handy saws are powered by engines of 2.8-cubic-inch capacity.

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Will the saw you're thinking of buying run well upside down?

That question is important. To trim a fallen tree, you must turn a saw to all positions, even upside down. In above photo, Al Lindsley turns over the new Pioneer Holiday. Used so, he found that its

iron bore over chrome-plated aluminum alloy. It's true that cast iron can be honed out for an oversized piston if you reach that stage of wear. Pioneer says they have a repair procedure that brings badly worn chrome bores back to like new. Few users will ever have reason to give the matter a second thought.

And horsepower? Ask about this in chain-saw circles and you're marked unknowledgeable. The difficulties in establishing genuine ratings for these mighty little engines, and the advertising people's natural inclination to fudge, caused horsepower to be dropped as a measure of saw performance some time ago. From Burkett of McCulloch, we get the view that displacement is the only yardstick used. It helps give some concept of the approximate size and muscle of the saw.

These are all extremely high-speed, two-cycle engines, made to run wide open. Top speeds give some indication of engine quality since it takes a better set of innards to go fast.

What about weight? Certainly, less weight means less fatigue, easier and safer handling, more production. The bigger name brands tend to have the edge here. The makers design and produce their own engines to some of the most sophisticated standards in the engine-building art. Extensive use of magnesium and production control, impossible for the buyer of stock engines, gives them an edge. It's worth noting that quoted saw weights are usually for saws without chain and bar (regarded as an option).

Shop around. Chain saws, like any other article you buy, appeal in different ways to different customers. Ask the dealer to start the saw. Invert it and let it run idle on the counter top. Point it straight up and down and roll it sideways to see how well the carburetor functions in off-level positions. Try the on-off switch for comfort and convenience. For safety, this switch should be within instant reach of your thumb on the trigger hand and should be clearly marked for on or off. Take a look at the access to the air cleaner.

Check for chain-adjustment method and convenience. All chains stretch and require adjustment. Just to be realistic, ask the dealer for his service-parts price list. Differences can be astounding.

Special features. Most saw makers have certain special features, often as extra cost options, to attract buyers. Automatic chain oiling is one of the best. The chain sliding at approximately 40 m.p.h. in its bar groove requires regular lubrication. This periodic squirt of oil from a separate tank is normally furnished by the operator's shoving down a plunger. The oiling is easily forgotten, so an automatic oiler is a worthwhile option.

Every saw maker admonishes the user to keep the teeth sharp. This is not too big an order for the experienced saw man. He sinks the blade bar into a handy log,

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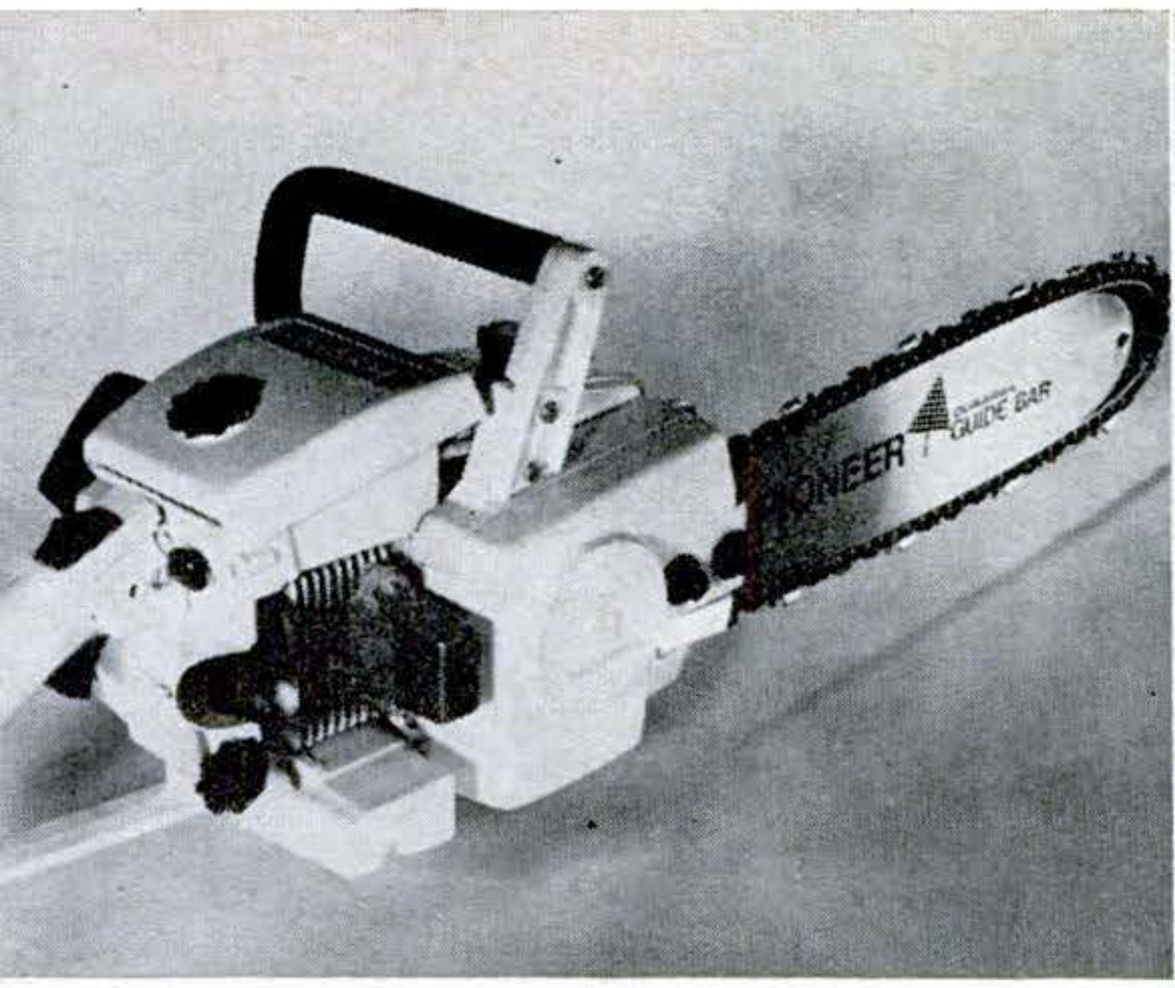

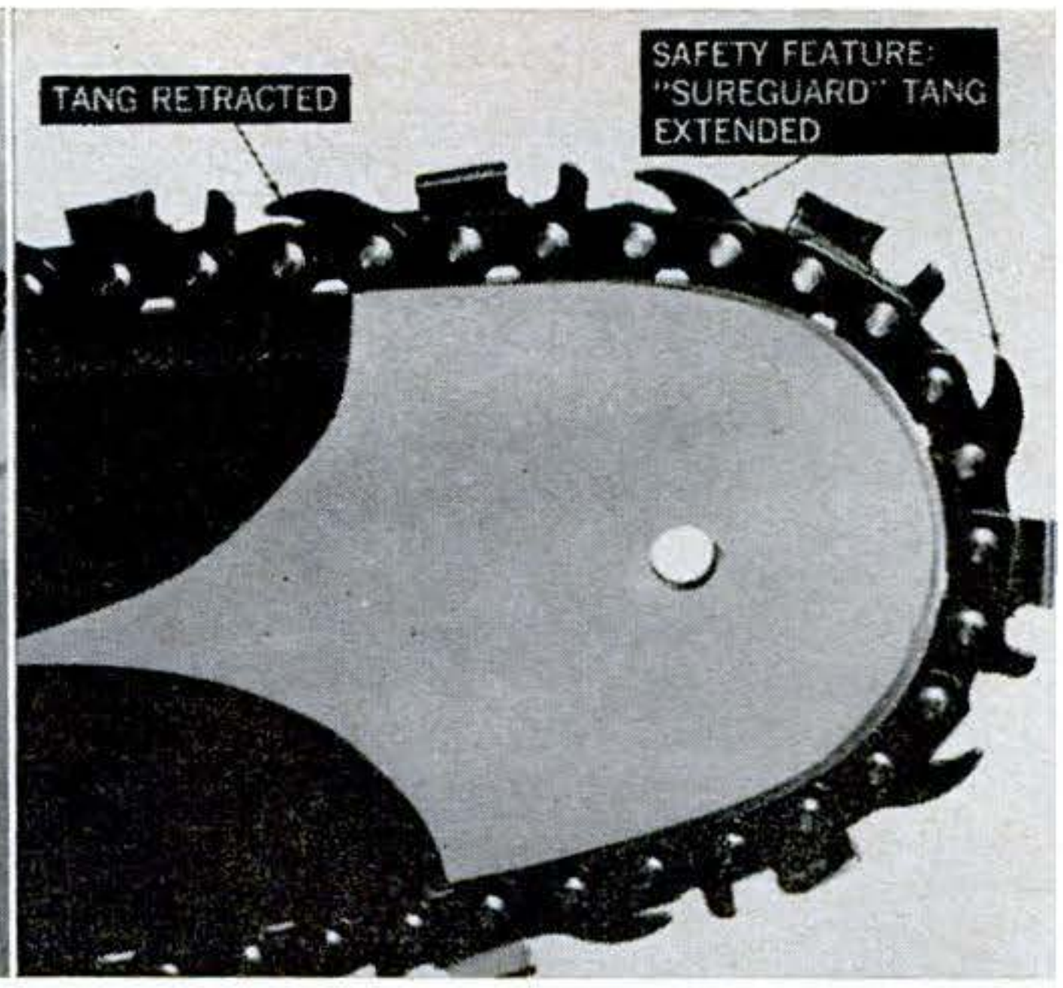

diaphragm carburetor let it pass with flying colors. The 12-pound direct-drive saw, shown upright above, is powered by a single-cylinder, two-cycle gasoline engine with a 3.54-cubic-inch displacement. Chain speed is 3,270 feet per minute. Centerlink tail design on the Holiday (above) reduces kickback hazard. Tang retracts in cutting area of the bar, then raises as the chain circles bar nose.

which serves as a saw vise, whips out the proper size of round file, and keens up the teeth in no time. Even with a built-in sharpener, it is claimed an occasional going over with the file is needed. Nevertheless, the built-in sharpener that does its work with a push of a button while the saw is running is attractive. Sears and Poulan saws are two that offer this.

Electric starters. McCulloch is now the only make offering this truly remarkable feature. Operating with a push of a thumb button on batteries charged by a built-in generator that doubles as a starting motor, this ingenious device offers quite a gain in safety to the wood cutter up a tree. The price keeps it out of the bargain-counter range, but no one who has tried electric starting can help loving it.

Another interesting item that promises much is solid-state ignition, now available from Homelite. This frees the saw owner of breaker-point and minor ignition-system problems, commonly the cause of much hard starting and poor operation. Again, it is a deluxe item.

Pioneer Division of Outboard Marine has a "no extra cost" safety chain designed to reduce the kickback hazard. Chains are built with little spacers or depth guides between the cutting teeth, which serve as riding surfaces for the chain and control the amount of bite the teeth can take. Pioneer's chains have depth guides with clever little legs that kick up as the chain passes around the bar nose to keep this portion from excessively biting in and kicking back at the user. It seems to work very well. Pioneer also offers a muffler on their Holiday model to help keep Sunday morn-

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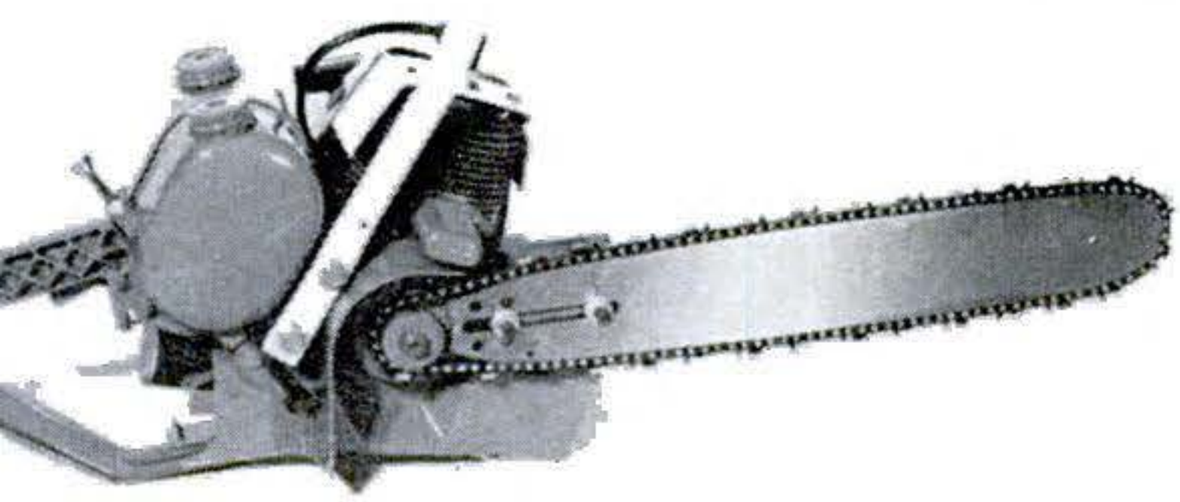
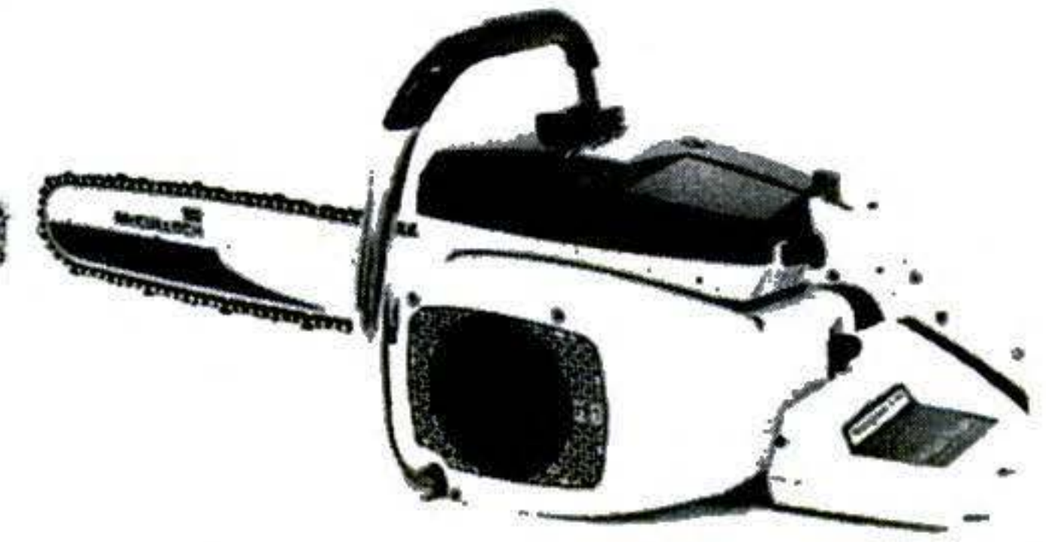


Sears Utility model at $99.95 is less sophisticated and heavier than some saws, but offers good service for firewood cutting and other use around a home.



Only chain saw with pushbutton starting is made by McCulloch. Notice the power pack under the handle. Model shown is the MAC 5-10E, weight 15 pounds.

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Typical Home-Use Chain Saws and How They Compare

Model	Weight (pounds; less bar & chain)	Displacement (cu. in.)	Bar Lengths (in.)	Oiler	Bearings	Features	Suggested Price
Homelite:							
XL-12	12.75	3.3	12, 16, 20, 24	manual	roller	roller nose (extra)	12″ 164.95 24″ 184.95
Super XL-12	13.75	3.55	12 thru 36	manual	ndle/ball	large oil/gas cap	12″ 184.55 36″ 224.60
XL-Automatic	14	3.55	12 thru 36	manual	ndle/ball	auto. oiling (extra)	12″ 204.55 36″ 244.60
Lancaster:							
4-40	18	4.7	16 or 19	manual	sleeve	push-lever chain tightener	16″ 127.95 19″ 135.45
5-40	18.5	4.7	16, 19, 24	manual	sleeve	(as above)	16″ 140.50 24″ 165.95
40-IL	16.25	4.8	16, 19, 24	manual	sleeve rod ball mains		N.A.
McCulloch:							
MAC 1-10	10.5	3.3	12 thru 28	manual	ndle/ball	40:1 mix, primer	12″ 164.95 28″ 199.00
MAC 3-10E	14.75	3.3	12 thru 28	automatic	ndle/ball	elec. start	12″ 269.95 28″ 299.00
Montgomery Ward:							
Powr-Kraft 24072	9.5	2.8	12	manual	full roller	roller nose	154.00
Powr-Kraft 24085	13	4.0	19	manual	full roller	roller nose	179.00
Powr-Kraft 24095	13	4.0	23	automatic	full roller	roller nose	199.00
OMC:							
Pioneer Holiday	12	3.54	12, 16	manual	roller	anti-kick	12″ 139.95 16″ 149.95
Poulan:							
31	16.75	4.18	16 or 20	manual	N.A.		16″ 129.95 20″ 139.95
361	13.75	3.60	12 thru 25	manual	ball & roller	pushbutton sharpening (opt.)	12″ 174.95 16″ 214.95
Remington:							
SL-9	9	2.8	12	manual	roller	roller nose; 2-yr. warranty	189.95
PL-4	12.5	3.6	15, 19, 23	manual	roller	roller nose; cushion grip	N.A.
Sears:							
Utility	19.9	4.71	16	manual	sleeve-rod ball crank	low price	99.95
35112	15.5	4.4	17 or 21	manual	N.A.	large engine	17″ 149.95 21″ 154.95
35132	15.98	4.9	17 or 21	automatic	N.A.	built-in sharpener	17″ 219.95 21″ 224.95
Electric Saws		**Amps.**					
Remington:							
EL Voltmaster	16.5	12/115V 6/230	14 or 19	manual	ball	auto. o'load	N.A.
Sears:							
35857	10 (comp.)	12/115V	10	manual	ndle/ball	lightweight	69.95
35858	10.4	12/115V	14	manual	ndle/ball	lightweight	79.95

ing peace in suburbia. This is an extra.

All-electric saws are also available. Remington is an old hand in this field. Sears and Niagara sell them, too. Handy within cord length of an AC supply, they are especially adapted to trimming and limb cutting. Teamed with a portable generator, an electric can go anywhere. Many find instant starting preferable to pulling a starting cord. An electric saw is a good choice for general yard use. An ideal system if you cut your own firewood is to own a husky gasoline saw for felling and cutting up the tree, backed up by an electric at home for trimming

[*Continued on page 207*]

TO REMOVE SECTION, run your thumb firmly along center fold. Then open magazine wide at this page, rest it on table, and pull out the sheets gently, one at a time.

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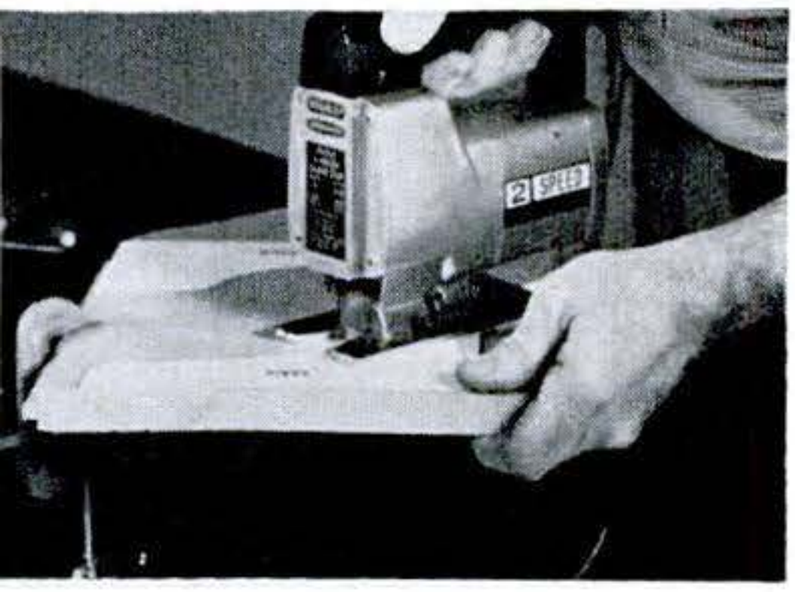
Shop Talk

By ROBERT P. STEVENSON

BernzOmatic will now repair new torches for free

Buy a new BernzOmatic propane torch and you'll never have to spend a cent for repairs—as long as you live. The BernzOmatic Corporation has announced a lifetime (the buyer's lifetime) guarantee on its five torch lines. If anything goes wrong, you ship the torch to the factory. They repair it, whatever the cause, and return your torch or a new one. A spokesman tells me recent improvements include a brass-mesh screen to eliminate orifice clogging and a fluted design of the torch head.

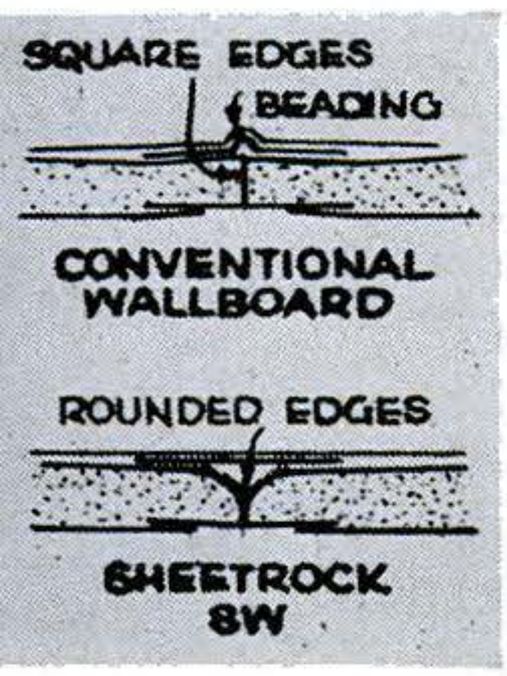


Two-speed Stanley saw fits your hand for good control

Doing some cutting a few days ago with Stanley's two-speed Job Master saber saw, I couldn't help but note how well the contoured handle fits the hand. Not only is the grip comfortable, but you can steer the blade right where you want it, smack on the line. That's a big improvement over the first saber saw I ever handled, nearly 20 years ago—the kind you gripped around its motor case. The Stanley two-speeder gives you a choice of 3,000 or 2,400 strokes a minute to suit the material. Price: about $40.

Translucent plastic gives you privacy—and lots of light, too

Home owners who'd like to put up a privacy screen can take a tip from a recent law suit in San Francisco. A home owner there put up a screen made from translucent plastic panels. This stuff is almost transparent when you stand near it. But only a few feet away it obscures visibility nicely. A neighbor sued, contending the screen cut light from his yard. Experts for the company provided proof that this wasn't true—that the material actually increases light by diffusion. The court agreed. The product was Filon, made by Vistron Corp., Hawthorne, Calif.



Joints between new type of wallboard remain flat

Next time you put up wallboard, you may want to think about U.S. Gypsum's new Sheetrock SW. It's designed to eliminate the ridging and beading that have marred wallboard joints in the past as a result of extremes in temperature and humidity. The new wallboard has a rockhard rounded edge instead of a square edge. As the sketch shows, joints made with the new material are more likely to remain flat.

New reading matter that you may want to check out

Another of our contributors has written a book. This time it's Paul Corey, who lives in a house he built himself atop a ridge adjoining California's romantic Valley of the Moon. The subject, appropriately enough, is vacation homes. The title: *Holiday Homes, a Build-It-Yourself Handbook*, published by Thomas Y. Crowell . . . For 50 cents, the Donley Bros. Co., 13900 Miles Ave., Cleveland 44105, offers a 36-page booklet giving good tips on building outdoor fireplaces and barbecue equipment . . . Want ideas for building a new home? Get them from a 12-page full-color booklet available for a dime from Dept. 525-L, Western Wood Products, Portland, Ore. 97204.

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BENCH SAW? RADIAL? New

By HARRY WICKS

If you own a bench saw, chances are you have sometimes wished for the advantages of a radial-arm saw in cutting wide stock. Now you can have those advantages—and keep your old saw, too. A new conversion kit puts the bench saw on rollers and lets it move along a track while the work remains locked in place.

This surprising development comes from a firm that has been making low-cost power tools for years—the American Machine & Tool Co., Royersford, Pa. The saw-conversion kit cost only $14.95.

The principles involved in the conversion have been in use industrially for years. But until now, costs kept such equipment from the home workshop. The kit reverses ordinary bench-saw operation. Instead of pushing work through the blade, you keep the stock motionless and pull the saw through—in effect, it's an inverted radial-arm saw.

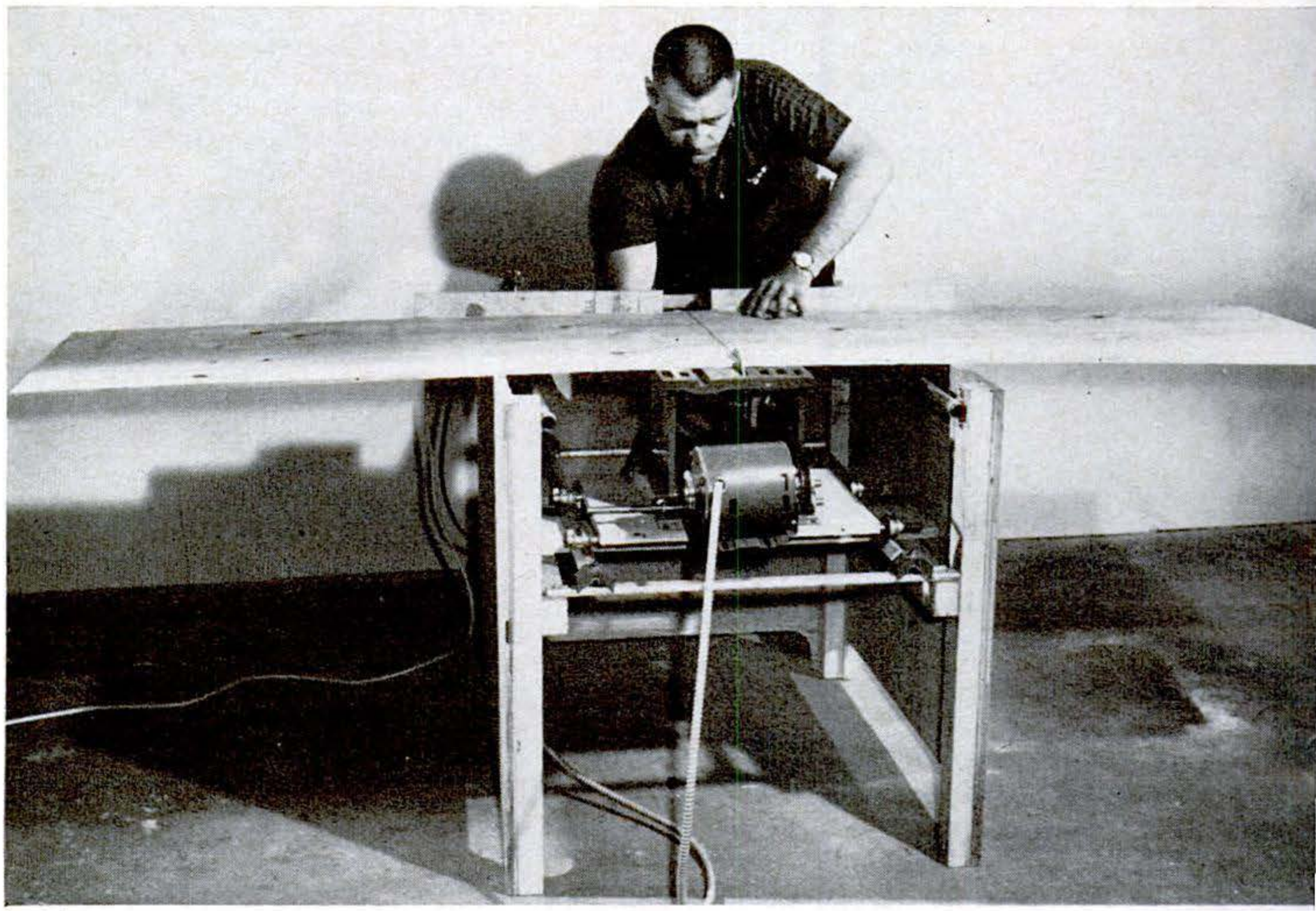
But is the kit any good? To find out, I converted my own 8″ bench saw.

Conversion is simple. The only materials you must buy are a couple of two-by-threes, and a panel of ¾″ plywood. It takes about two hours to build the box.

There's only one variable dimension in construction: location of battens. The height of the bench saw, from bottom to work surface, determines this measurement. Once the battens are in, the cross supports are installed. Although nails can be used for all joinery, I used screws and glue for a stronger cabinet.

Continued

Crosscutting a plywood panel that was 24″ wide and 8′ long was easy using radial action. There is no chance of the workpiece drifting, because it remains stationary while the saw is pulled through.



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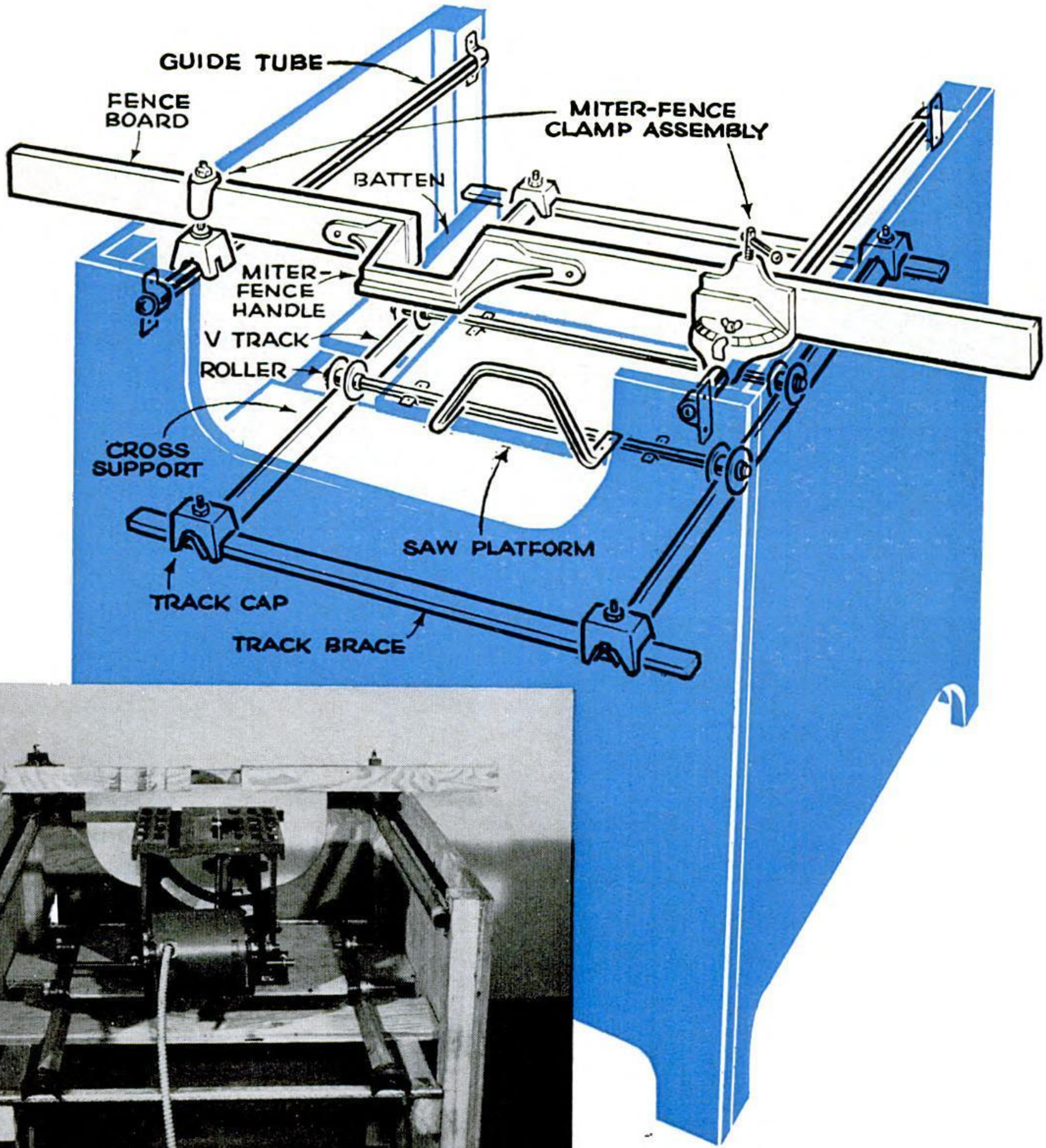
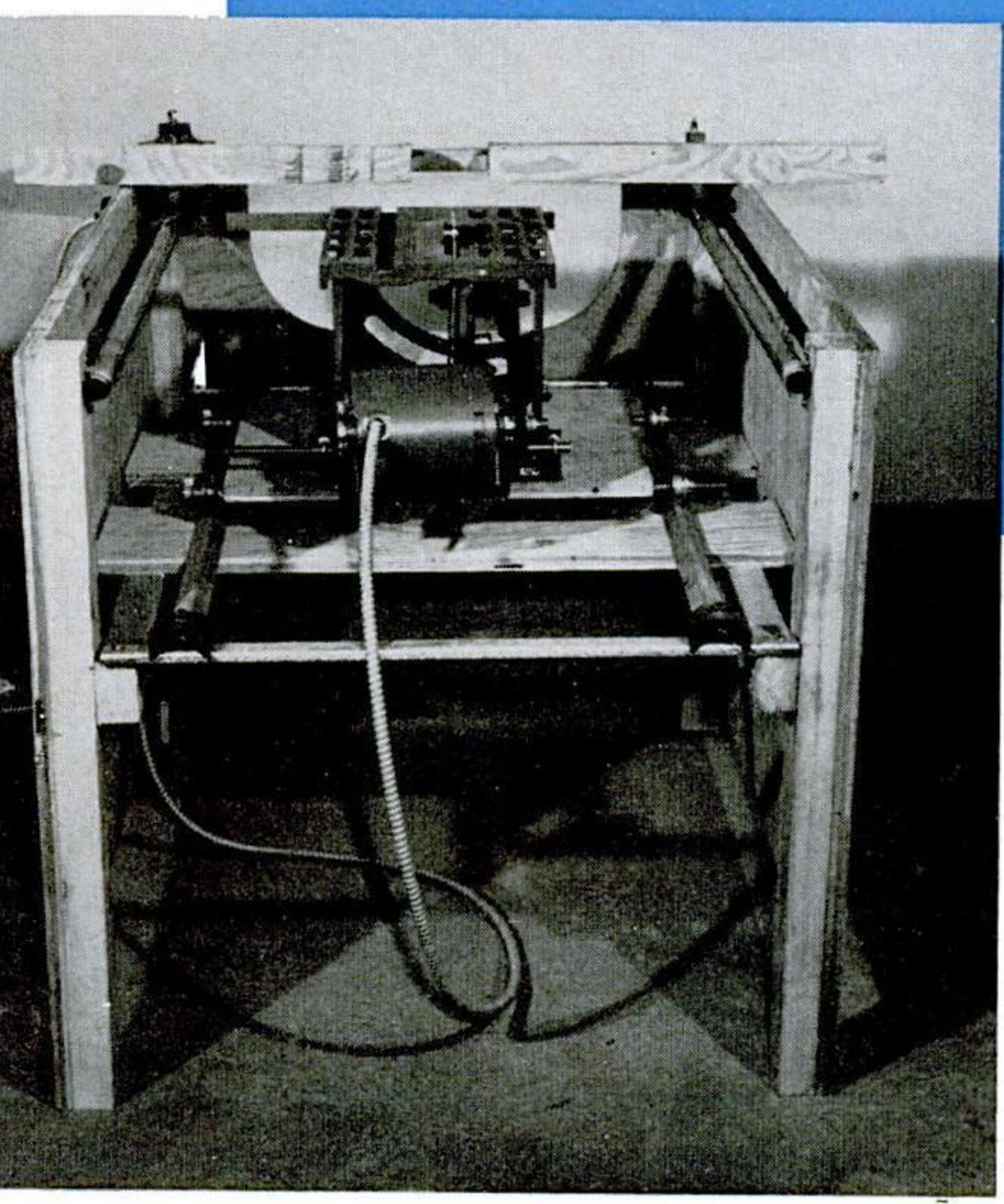
Kit Gives Advantages of Both





The parts that come in the kit are shown above; you supply two pieces of two-by-three and a panel of ¾" plywood. The only variable dimension when building the box is batten location. The height of your saw (see photo at left) from the bottom to the work surface determines this measurement.

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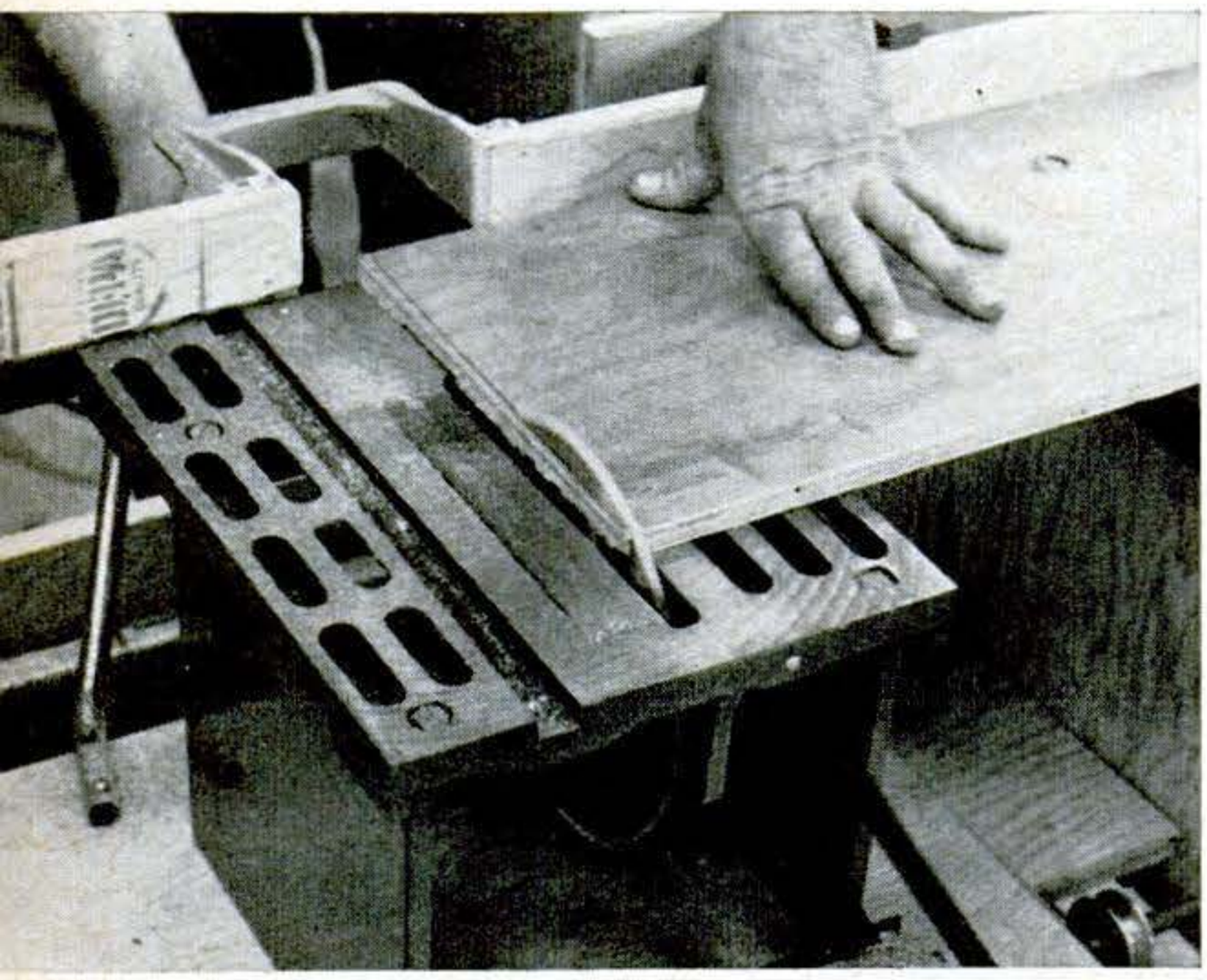
Next the vee tracks are laid out and fastened. The saw is then centered and mounted on a platform equipped with four rollers that travel on the tracks. Finally, a tubular handle, which gives you complete control over saw movement, is attached to the platform.



Small cutoffs on long, wide stock are a snap with radial action. Workpiece is simply held in place, and the saw work surface and box carry the weight.

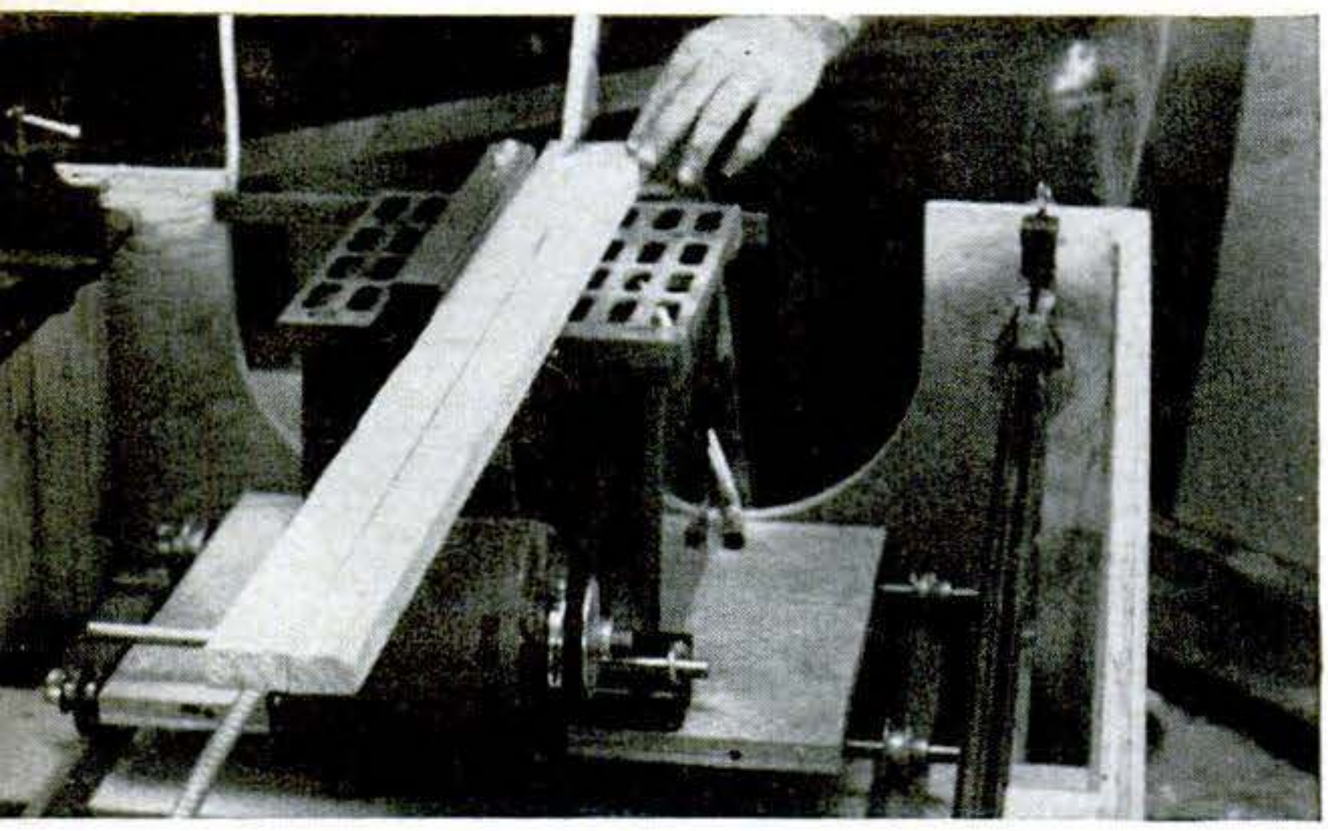
Two guide tubes are installed inside the box to accommodate the miter fence assembly. The miter fence is assembled by attaching two wood strips (which come with the kit) to the miter-fence handle. The miter-fence assemblies, on the guide tubes, are equipped with clamps to hold the fence boards.

You still have the bench-saw advantages. The saw can be used with or without radial action. This means you can select the setup that best suits the job at hand. For ripping, the saw is rolled to the front of the box and locked in place with a wingnut. The miter fence is removed by loosening one nut on each clamp assembly. And the saw can still be lifted out for outside jobs. So bench-saw portability is not lost.

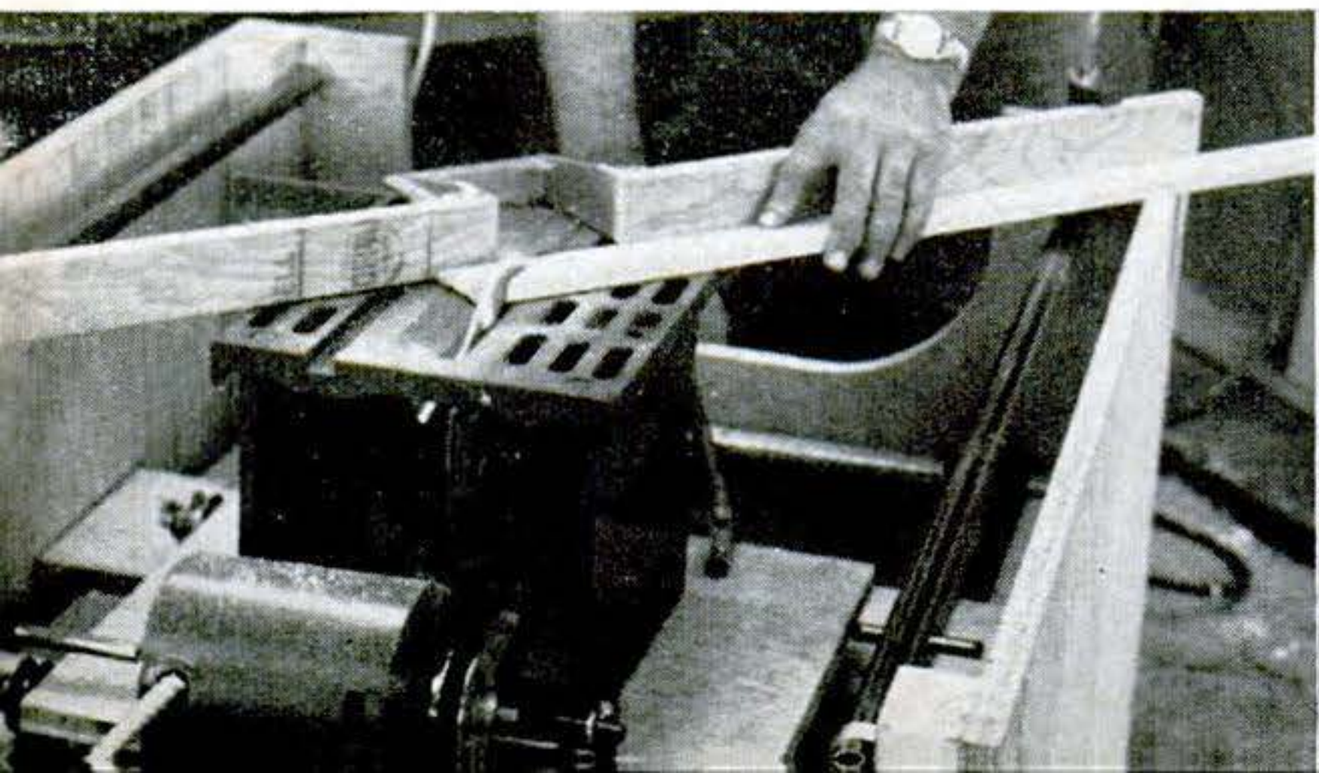
Test results. The converted saw was put through all the standard cutting operations, and it performed smoothly. Bulky work was easy to handle, even when crosscutting as little as 1/16″ off a 10″ board 7′ long. I even (successfully) tried this cut: After ripping a full plywood panel down the middle (with the saw set up as a bench saw), I switched back to radial action to crosscut the 2′-by-8′ panels in half.

The maximum width you will be able to cut is determined by two factors: Size of your saw and where it sits on the rolling platform. The maker claims that most saws will handle up to 20″ on straight work, and 12″ on miters.

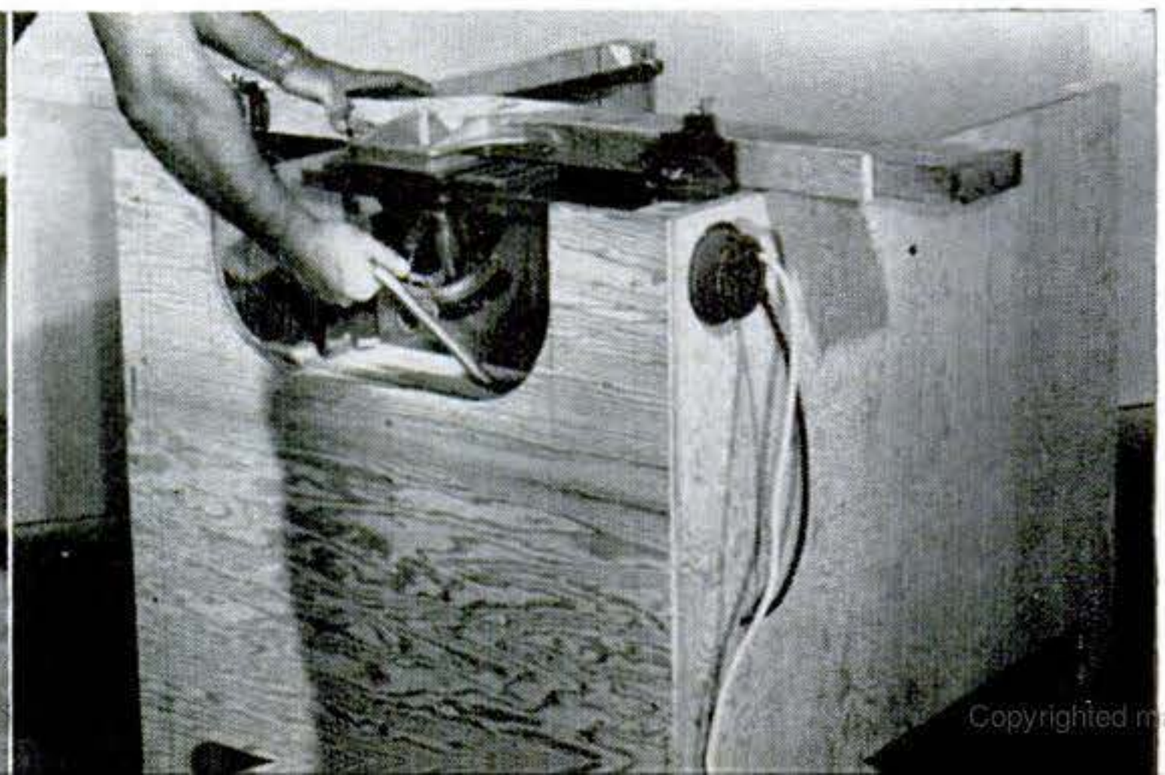
Miter work was easier using radial action, and the cuts were totally accurate. And when crosscutting two-by-six stock with a long, heavy overhang, it was a pleasure not to have to contend with the board's weight. PS



For bench-saw tasks the fence assembly is removed, and the saw is locked in place. With this rig, you can pick the best setup for the job that's at hand.



To cut miters, both clamps are loosened, and the fence boards are positioned at the desired angle. Miter cuts up to 12″ are possible with this rig.



Crosscutting heavy stock was easier using radial action because the operator does not support the weight of the board. This two-by-six is 6′ long.

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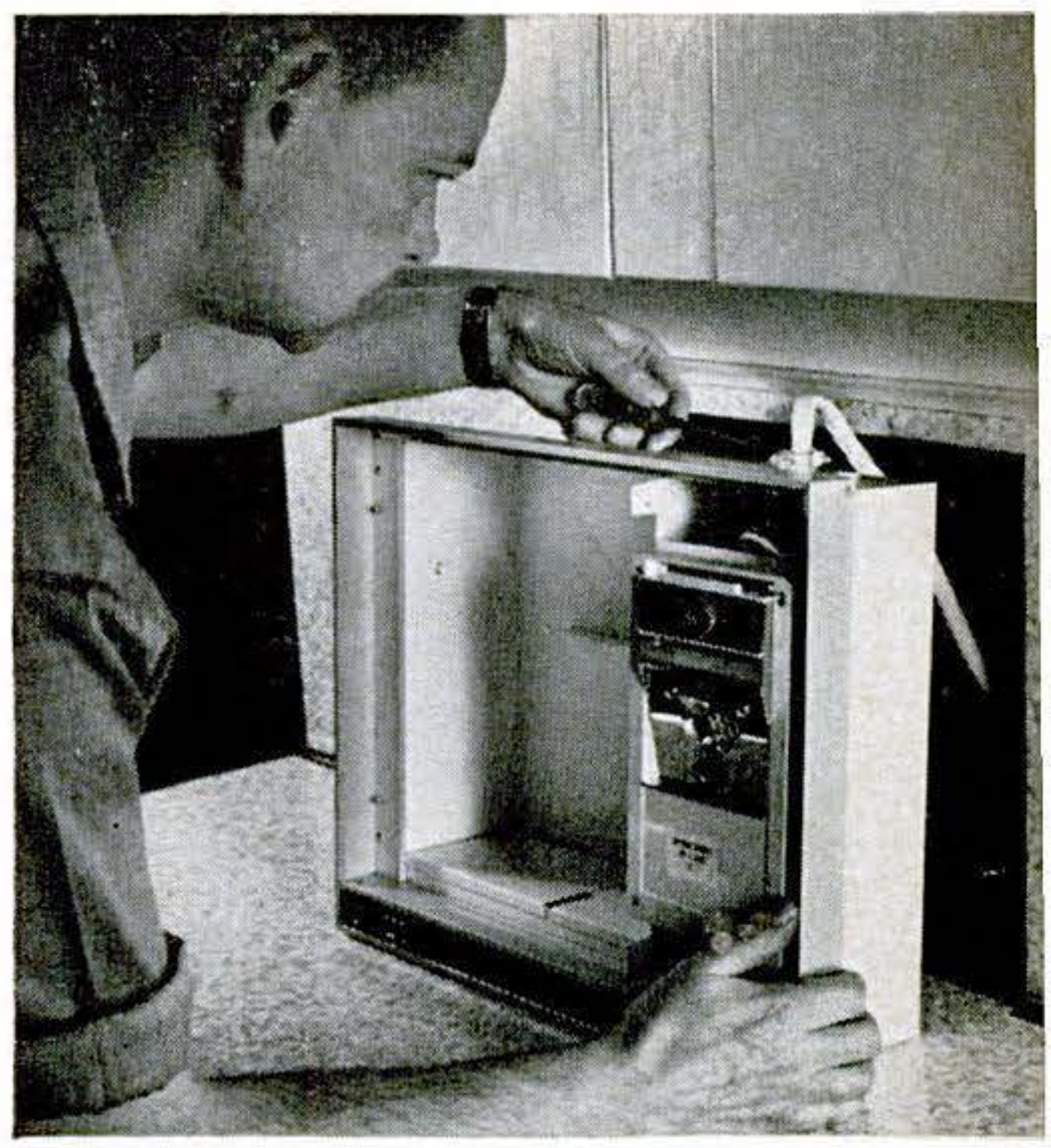
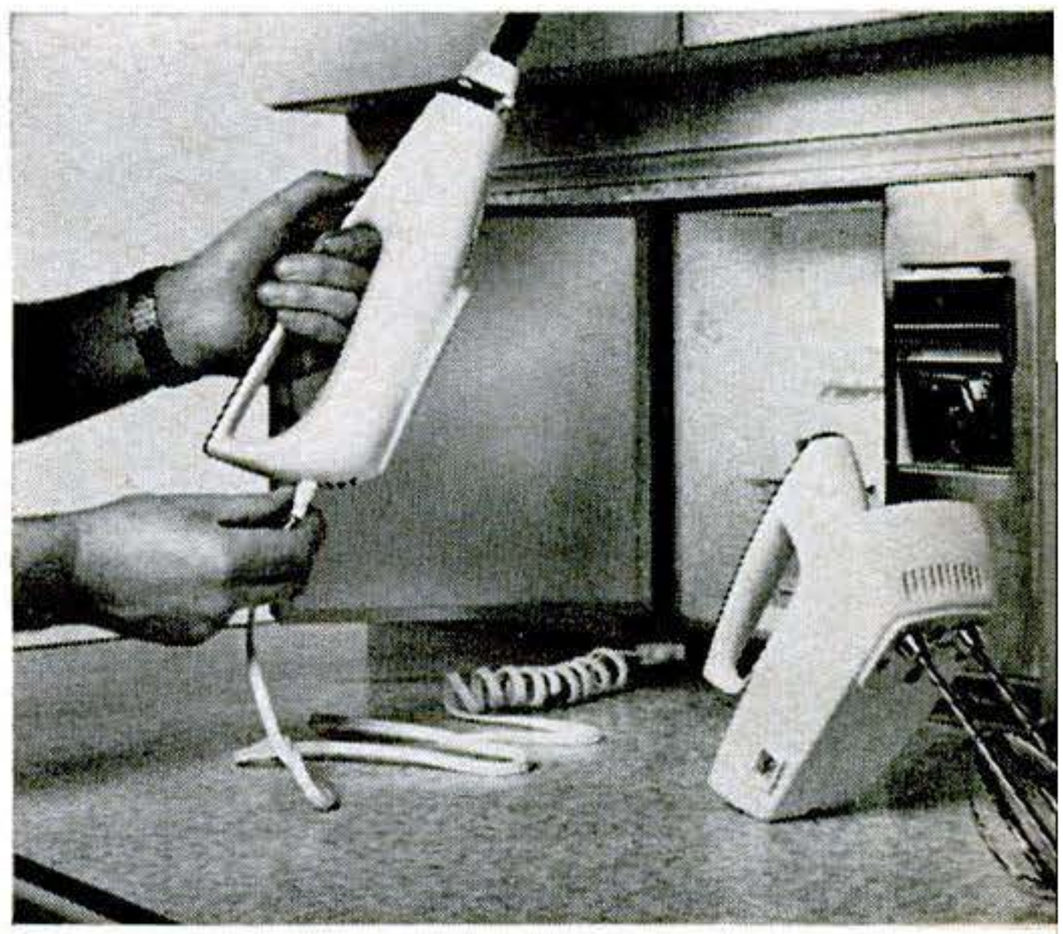


After cutting the opening, run power through the wall and connect to the unit. Screws hold the box in place.



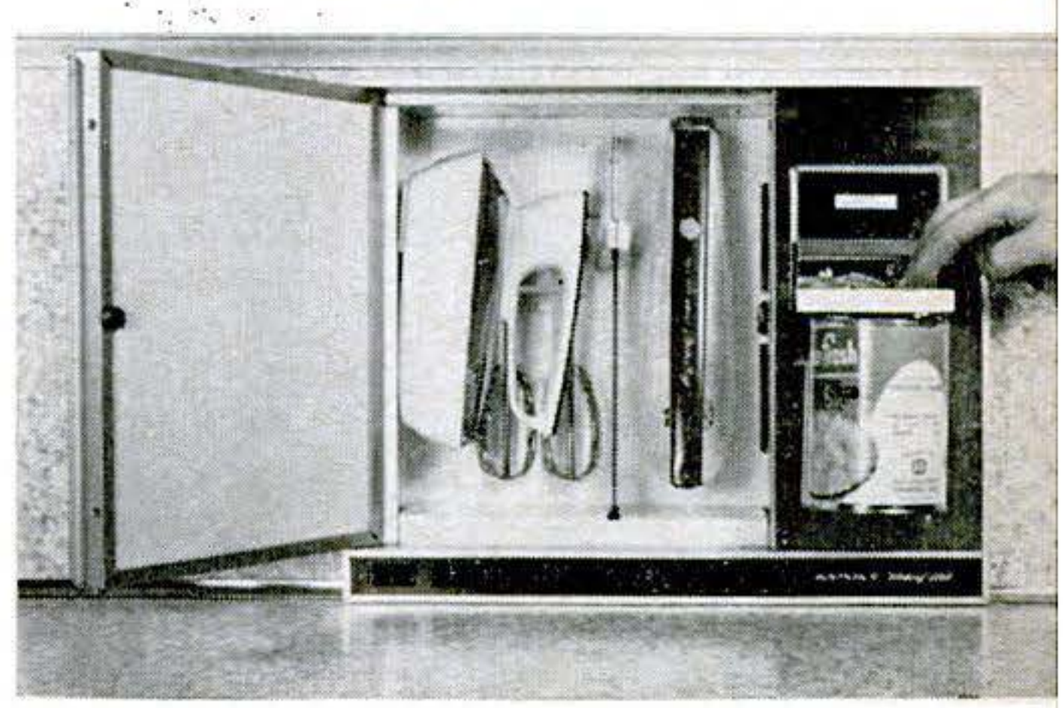
The Working Wall keeps appliances in one spot, with power handy. The portable mixer features beater ejector.

New Built-In for the Kitchen Wall

It stores portable mixer, knife, and can opener ready for instant use

Electricity is here to stay. And so are the increasing number of labor-saving appliances. But each time you buy one, you have to worry about storage. The Working Wall by Hamilton Beach solves that problem, and leaves the counter top free of clutter.

The unit includes three appliances: electric can opener, three-speed portable mixer, and electric carving knife. Installation is simple; just make sure that your backsplash is high enough to accommodate the unit's 13-inch height. The job involves cutting a rectangular hole in the backsplash and wall, between studs. You run power to the opening from the most convenient source. The unit is held in place with screws. The Working Wall is not sold through retail outlets; you can get information about it from John Flaherty, Hamilton Beach, Racine, Wis. 53404.



Counter space, and cabinet and drawer storage, is saved by putting three bulky appliances in the wall.

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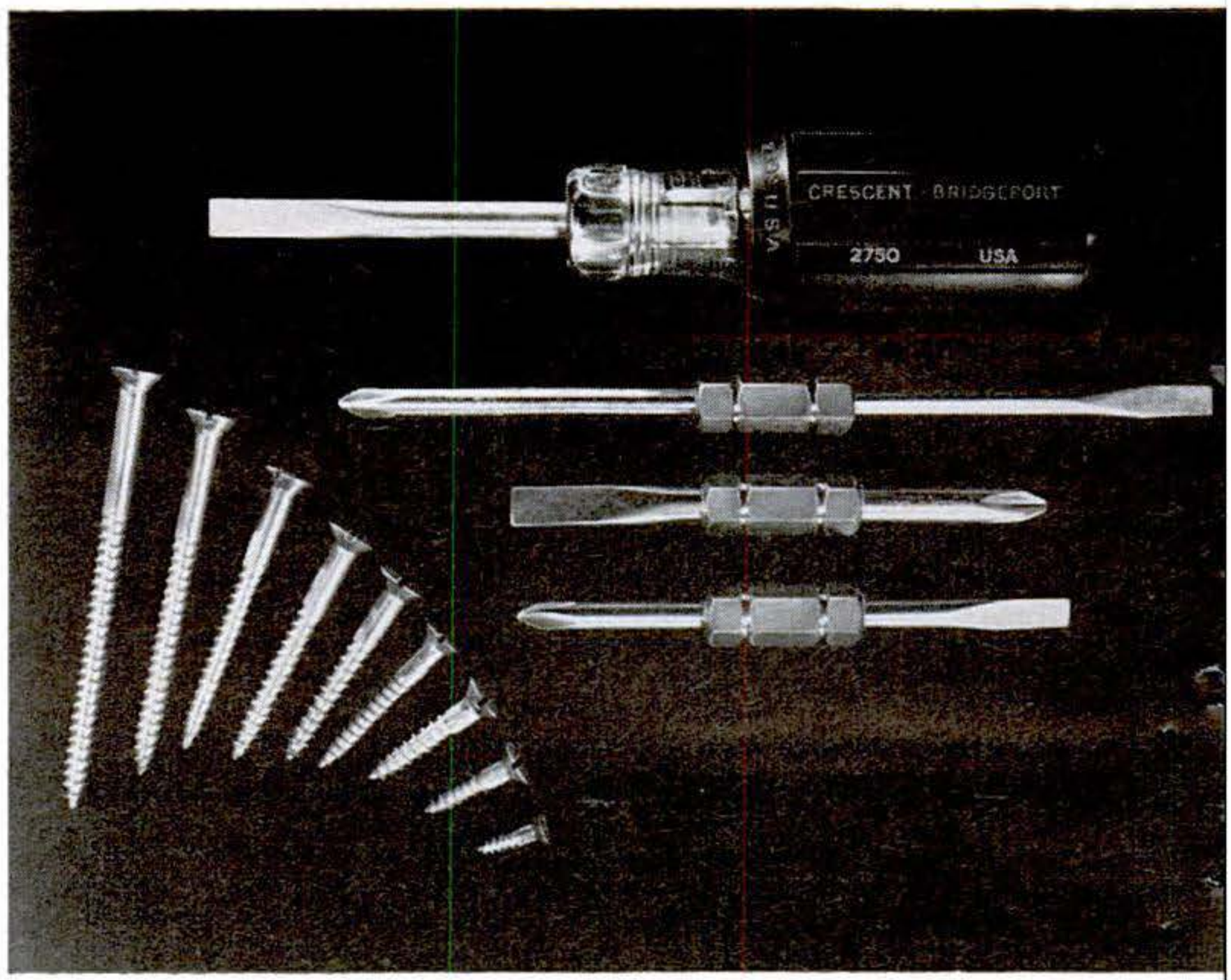
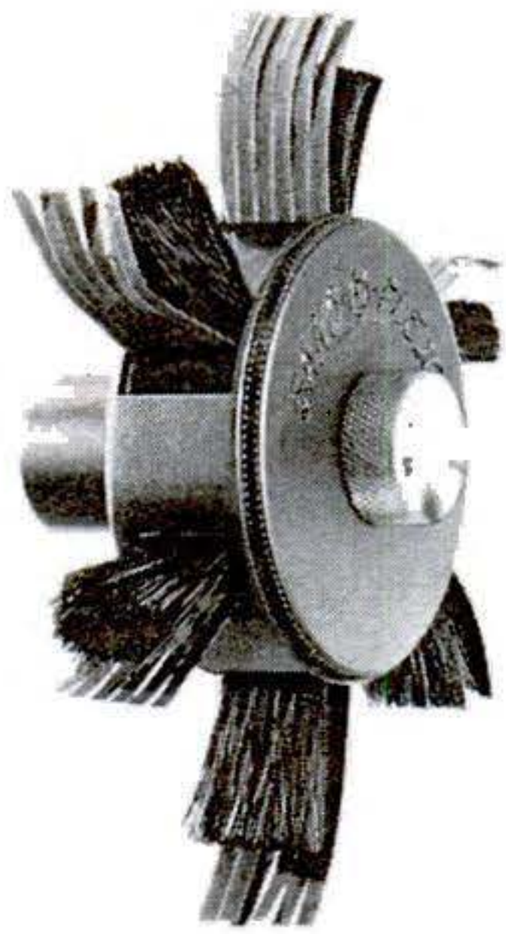
New Tools for Home Upkeep



A new reversible screwdriver by Crescent lets you carry one tool that will do the jobs of eight. Each set contains four double-ended blades, in standard and stubby length, and a cushion-grip handle. Blades are easily changed, lock in when inserted. At left are some of the slotted and Phillips screws the tool is able to handle.

Shopmate's portable sander is two tools in one. Just flip a lever and it converts from orbital to straight-line sanding. Use orbital action for heavy stock removal, and straight-line for polishing and finish sanding. The sander comes with a six-foot, three-wire cord and is equipped with roller bearings and dust shields. The tool works equally well on wood, plastic, metal, and composition materials. It sells for $30.50.



Contour sander—the same tool that pros have used for years on tricky contours—is now available in a home-workshop model. The Sand-O-Flex sanding wheel attaches easily to portable drill or bench motor. Firm bristles force abrasive strips into hard-to-reach spots for fast, easy sanding on complex surfaces. The wheel can also be used on ceramics, fiberglass, and metal. $14.95. Merit Abrasive Products, 5515 W. 104 St., Los Angeles.

Portable generator, the new McCullough 5-20, incorporates special design features for greater flexibility. It provides up to 2,000 watts of 115-volt or 230-volt electric power—a double-throw switch lets you choose. The voltage, as shown on a voltmeter, can be adjusted by the throttle of the five-hp. engine. The unit is fused to protect electrical equipment. McCullough Mite-E-Lite, Inc., Wellville, N.Y. 14895. About $350.

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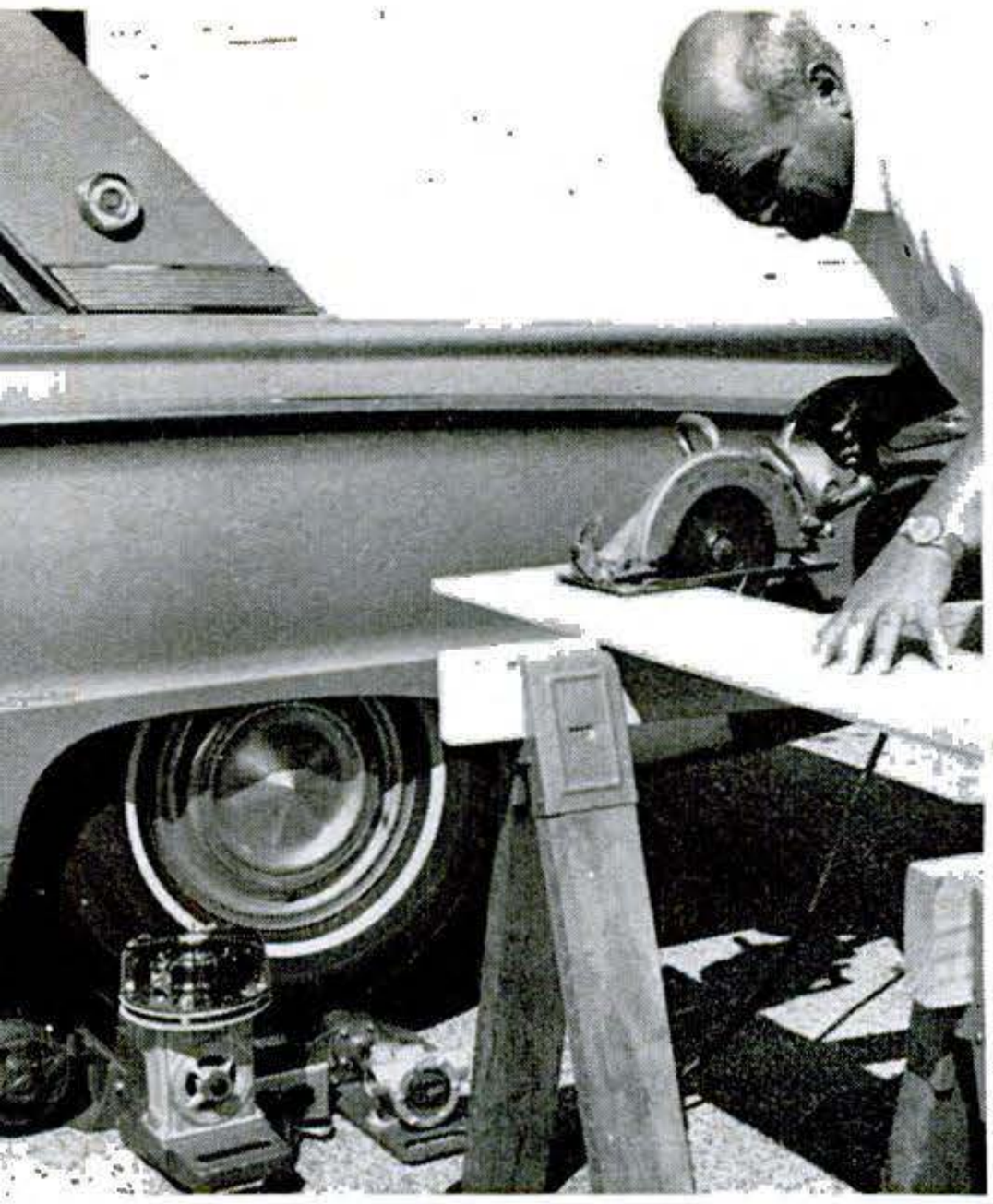
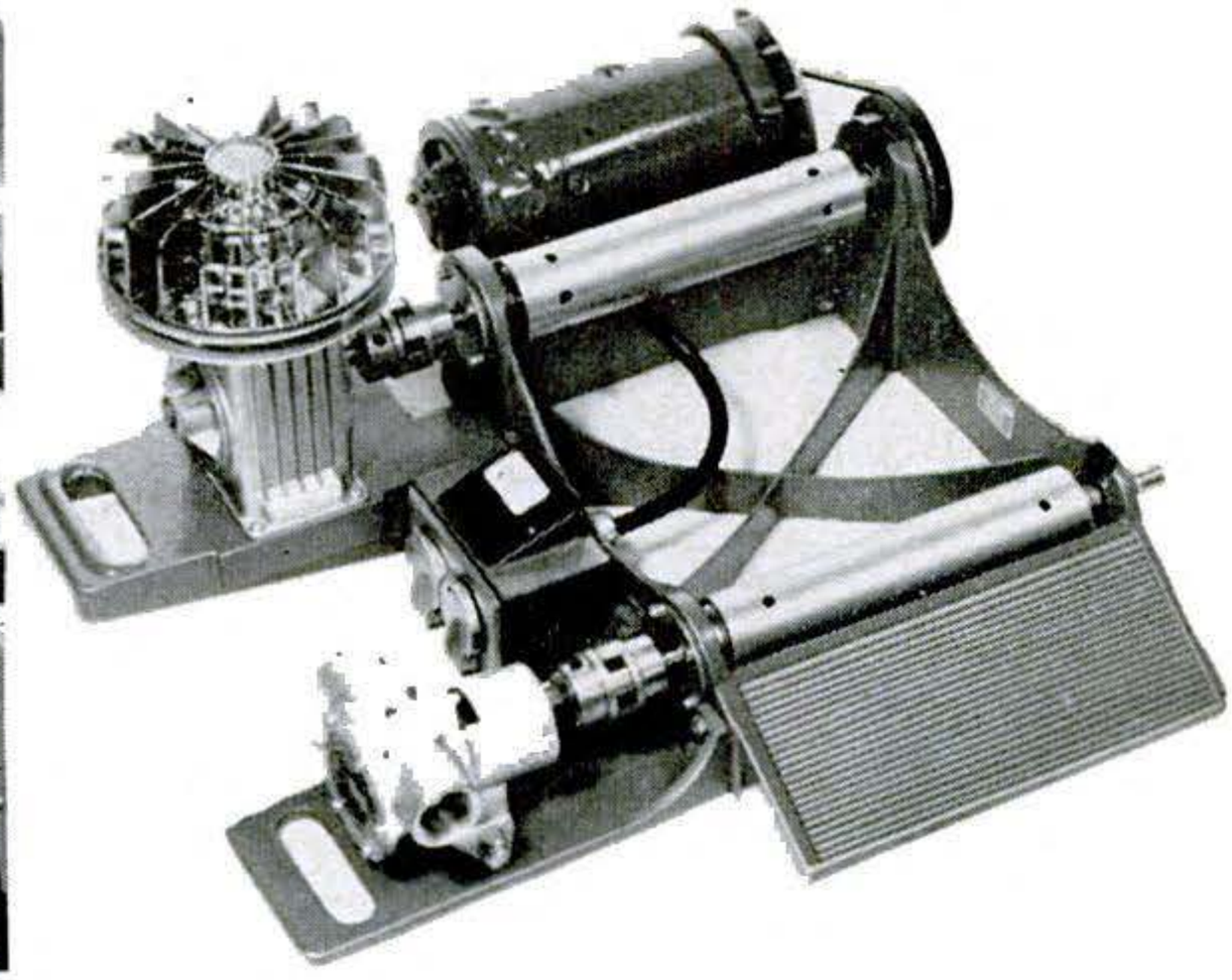
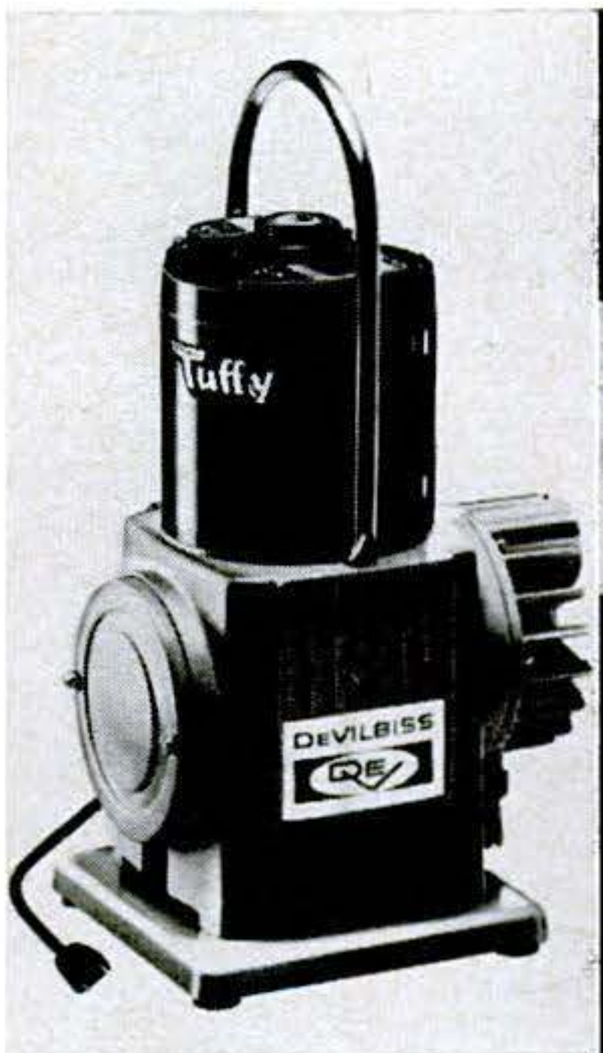


IMPROVE YOUR HOME

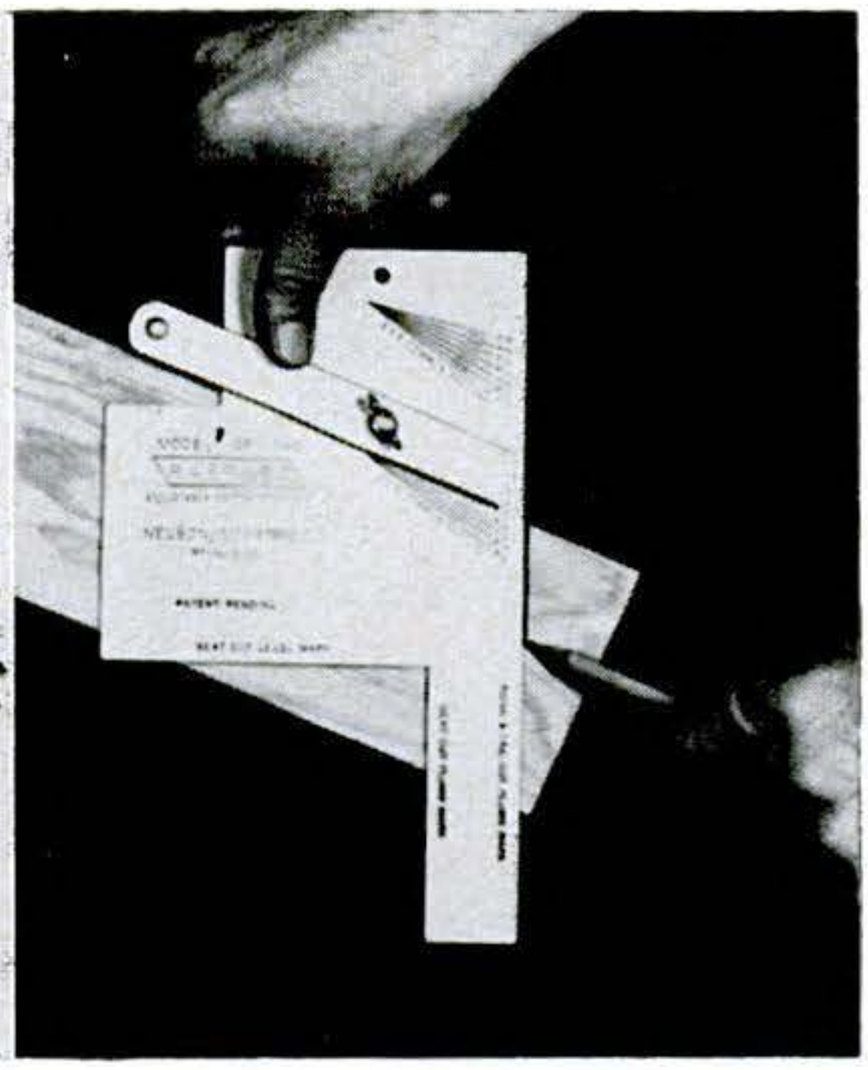


Mobile Power Pack converts energy from the rear wheel of an automobile to power for any number of jobs. The basic unit is driven by the rear wheel of a car with the engine idling at low speed. It drives three components (photo above, right): electric generator, air compressor, utility pump. The complete pack, including all three components, weighs 62 pounds. Manufacturer claims units have been tested for over 300 hours with no abnormal wear. Rolon Corp., Santa Monica, Calif. 90404.

Brown's Bantam 205 sprayer is a compact, lightweight unit only seven inches long. But it packs enough power to handle any light spraying material. It can be used to paint household or outdoor items or to spray insecticides, liquid fertilizers, or mothproofers. It's good, too, for inflating swimming pools. The Bantam retails at $29.95 (West Coast $31.50). It's made by W. R. Brown Corp., 2701 N. Normandy Ave., Chicago.



Diaphragm-type air compressor by DeVilbiss is designed primarily for professional-looking small jobs and for touch-ups. But it can also be used for inflating tires and sports equipment, or to clean drains. Belts and pulleys are eliminated in the new vertical design because the motor is connected directly to the compressor. Above is the ⅓-hp. unit, weighing 26 pounds; all weight is directly under the handle. DeVilbiss Co., Toledo.



Cutting template helps you cut rafters faster and eliminate guesswork. You make one setting of the template, take two measurements, and mark the rafter. Raft-Ez marks all cuts for two-by-four and two-by-six rafters and adjusts to various roof pitches. The template, of rust-proof aluminum, sells for $4.95. Nelson Industries, 1050 Magnolia Lane N., Minneapolis 55427, makes the tool, which is simple to use with the instructions provided.

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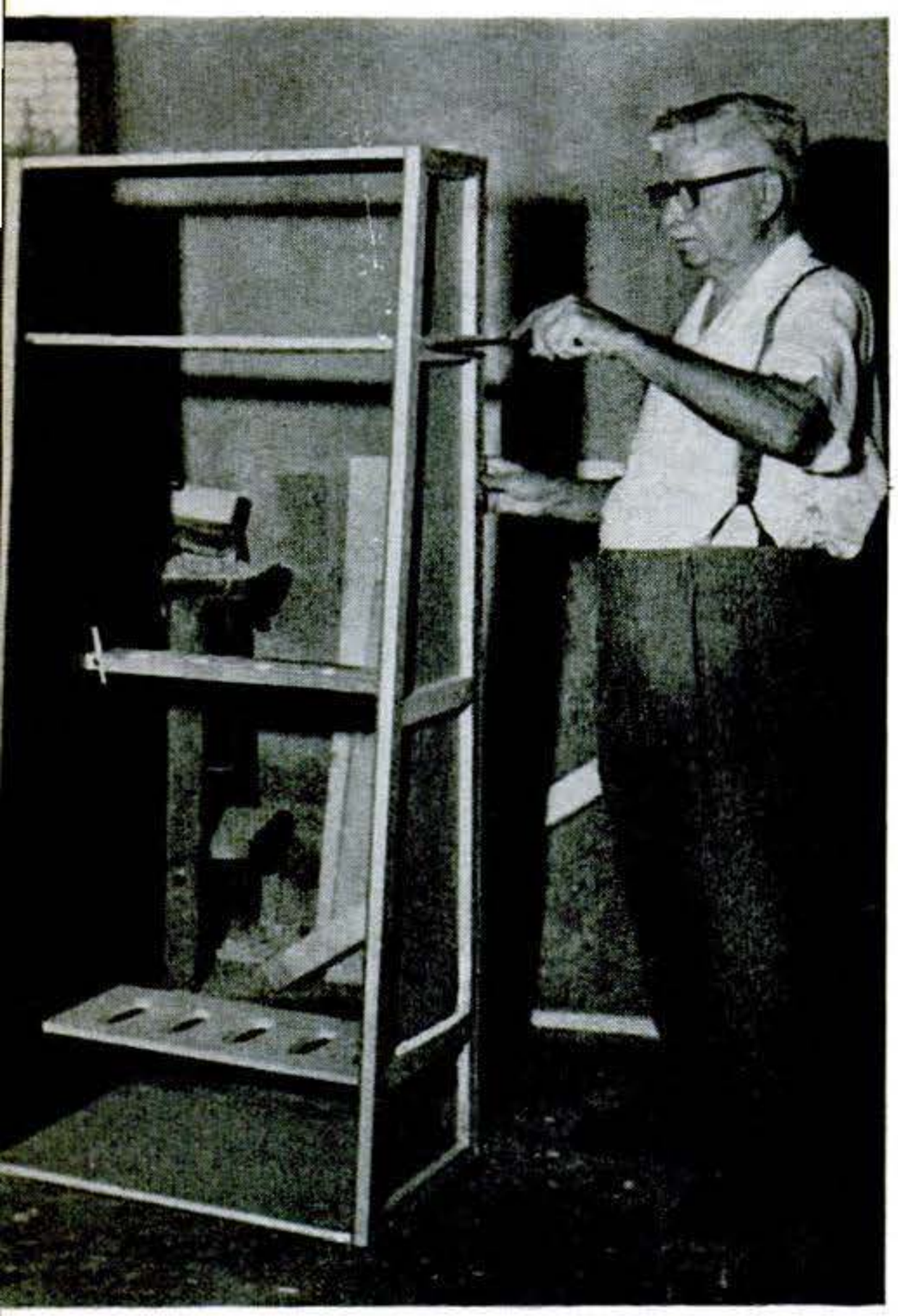
Lockup Gun Cabinet



To minimize cutting and fitting, the framework is paneled inside before the shelf and the gun racks go in. Tighten the screws after you have all three pieces in place.

This cabinet displays a collection of guns, yet keeps them away from children. A locking bar guards the rifles and shotguns and, although the fellow above displayed two pistols for the photo, shells and pistols are normally stored in a locked compartment. The cabinet is finished inside and out with matching Masonite walnut paneling and perforated board, making it practically maintenance-free.

The framework is built of one-by-two pine. Since it is covered with ¼″ paneling, you can use corrugated nails and butt joints. Panels were bonded to the frame with Royalcote panel adhesive. Particle board was used for the top, bottom, shelf, and gunstock rack.

How you build it. Start by building the framework for the two sides, front, and back. Next, bond the paneling to the inner surface of both sides. Attach the

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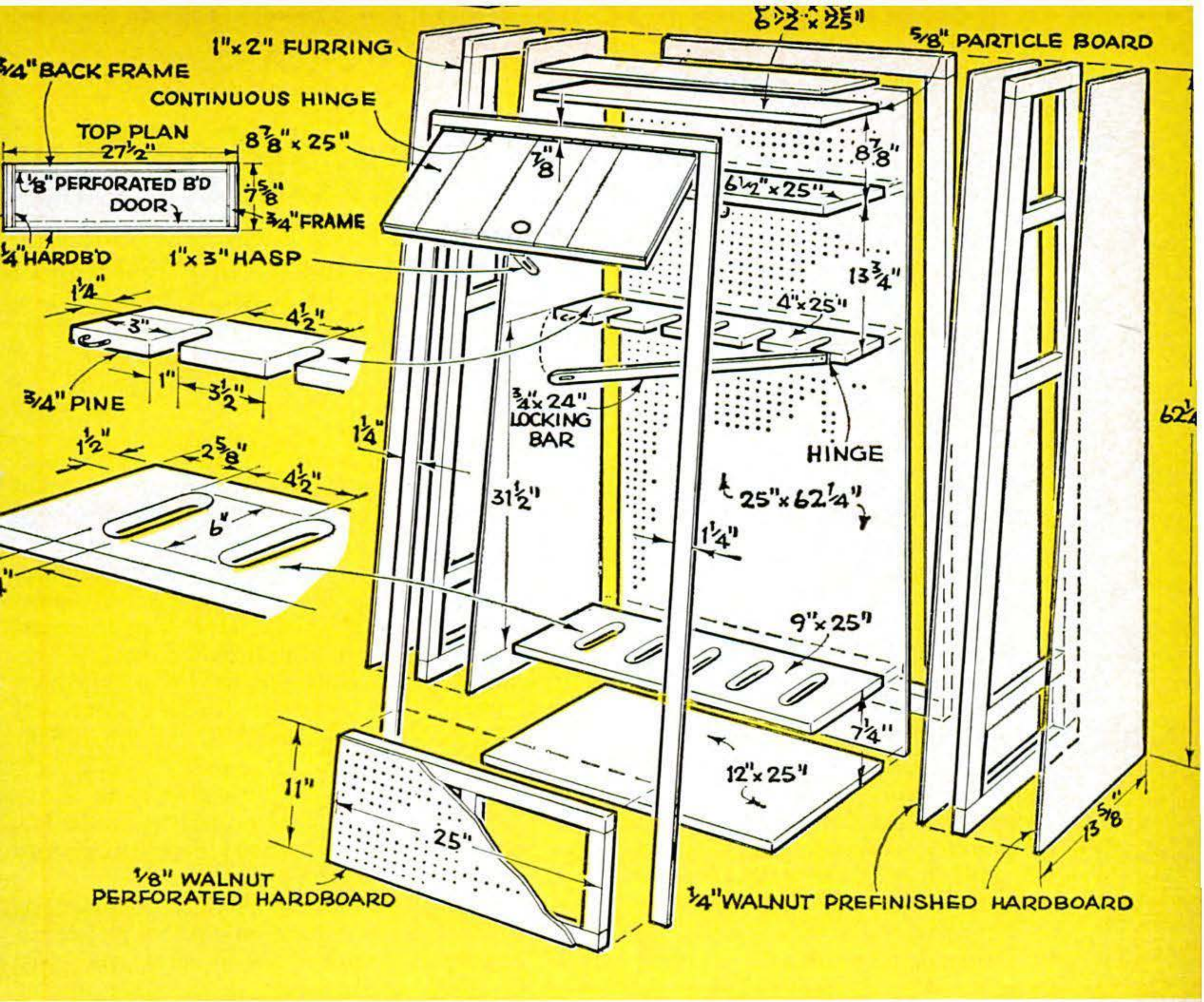

top and the bottom to the laminated sides, and stand the unit upright.

Shape the gunstock rack from the particle board and the barrel rack from pine. Use ½" stock for the locking bar and attach it to the rack with a small hinge at one end. Cut a slot at the other end so that the locking bar will slip over a staple that receives a small padlock. Install these parts, and the shelf, by screwing 2"-No. 6 wood screws through the frames. Don't drive the screws home until all three pieces are set in the cabinet. After the interior pieces are in, attach the front frame and bond the perforated board in place at bottom. To do the back, bond the perforated board to the frame first, then attach the assembled back to the unit.

Paneling the case. Panel the top of the cabinet first, then the sides. By doing it in this order, you will hide the edge. Use a few brads to hold the panels in place while the adhesive is drying. The last step in paneling the cabinet is to apply the trim strips to the exposed edges on the front of the frame.

The compartment door is made of ⅝" particle board and attached to the cabinet with a 25" continuous hinge, along with a hasp for a small padlock. The knob on the door is optional and if one is used it is centered on the door, 1" from the bottom edge. Panel the door edges first, then panel both sides (again to hide the edge). Stain all unfinished stock, with walnut stain, to match the prefinished material. To prevent the pine from showing through the perforated board, the front and back frames should be stained prior to bonding. Allow 24 hours' drying time before paneling.

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PERSONAL-USE REPORT:

Dremel's Powerful New

You really have to work hard at it to stall this neat handful of torque. The secret: a new kind of motor

By HARRY WALTON

Trying out Dremel's new Moto-Tool is like finding that the house cat has turned into a tiger cub. The looks are familiar, but there's something mighty different inside.

In the Moto-Tool, it's a new motor that doesn't know when to quit.

Engineers call it a constant-torque permanent-magnet motor. To you and me it means one that will keep grinding wheels and burrs buzzing at useful high speeds even when they're digging in. Yet the new model is ounces lighter, scarcely bigger, and lists at about the same price as the old one.

PS EXCLUSIVE!

Popular hand grinders will stall out at torque loads as small as 2½ ounce-inches (the torque unit for light power devices, as pound-feet is for car engines). But the new Dremel Model 280 won't stall until loaded to over 16 oz.-in.

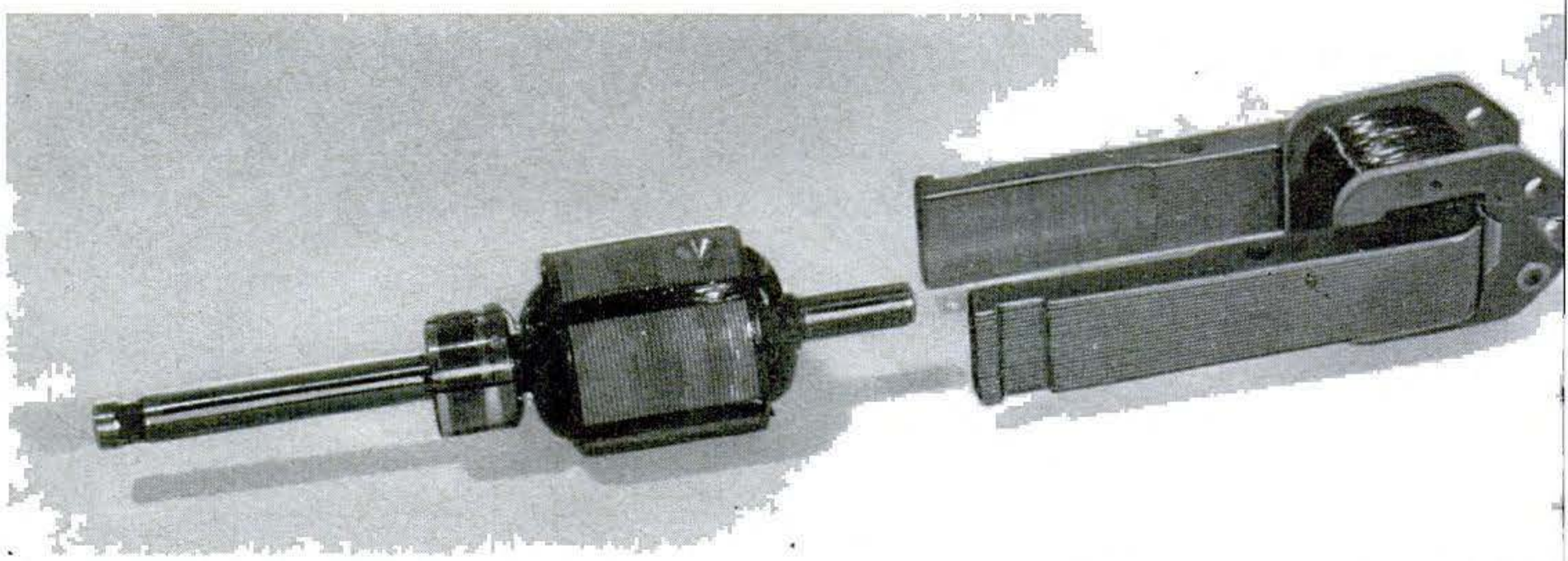
Dremel engineers told me they had drilled ¼" holes with it. This I had to try, crazy as it is to run a drill bit that size at hand-grinder speeds. I shouldered down the shank of one to ⅛" in order to chuck it.

That ¼" drill whizzed right through a fir two-by-four. A little care was needed to avoid stalling, but I've hung up ¼" electric drills on the same job. Next, I pushed the same drill—unlubricated because no oil would stay on at 30,000 r.p.m.—through ⅛" hard dural. It stalled on the breakthrough.

Neither stunt is recommended, but it was a masterful performance for an ungeared motor unit you hold like a pencil.

Muscle for carving. A ⅛" ball cutter cut its full depth in hard oak as fast as I could guide it. A larger ⅜" V cutter, fed hard to half its diameter, loaded the motor enough to lower its high-pitched song, but never stalled it. A 5/16" cylindrical burr sank to its full depth in the edge of oak stock in little over a second.

By comparison, the No. 2 Dremel had



Old and new Dremel motors are shown above, the old on this page, the new opposite. Unicoil field above was used in former Moto-Tools to keep down diameter. The five-pole armature has five commutator bars, no cooling fan. New permanent-magnet field has two pieces of highly magnetized barium

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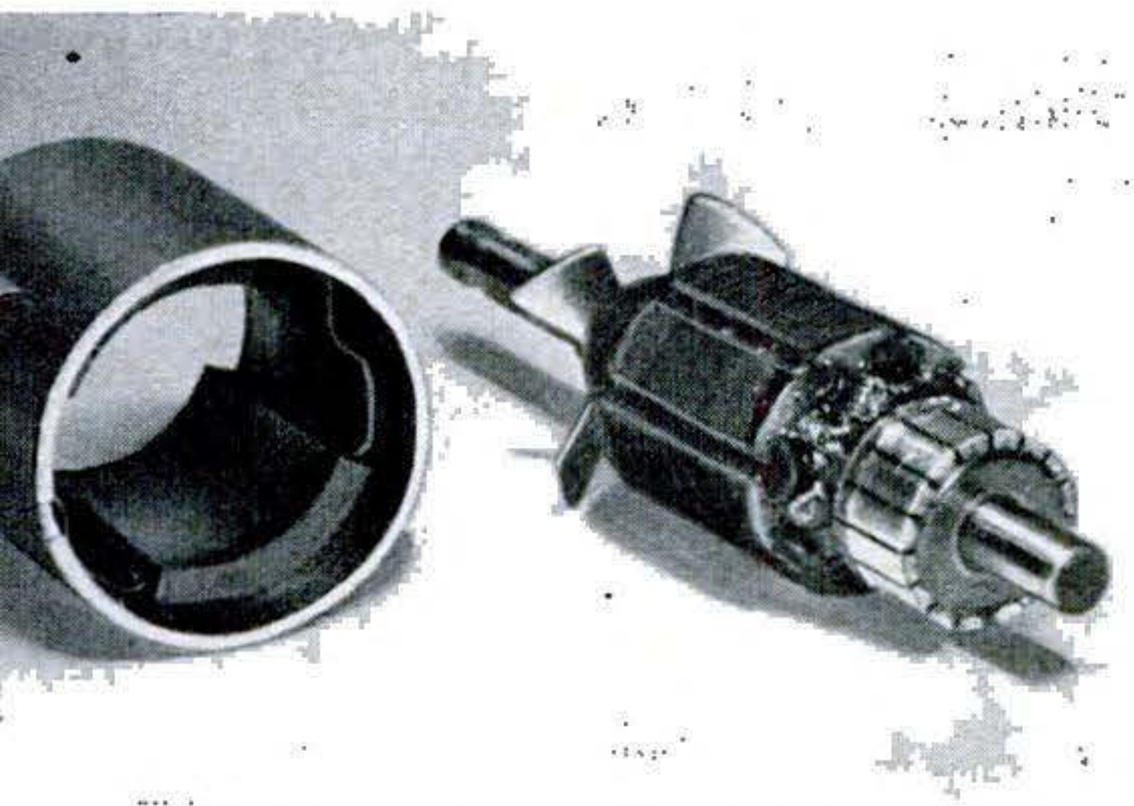
Moto-Tool

to be gently handled to do half as much.

Routing is practical, though you can't expect the Moto-Tool to do all the work a heavy-duty router can. Using Dremel's shaping-table attachment as a router base, I found a 1/8" bit did excellent veining to a depth of 1/8".



ferrite inside a steel cylinder. Armature has eight poles; winding is connected through 16 commutator bars to reduce arcing and TV interference.

In oak, 1/16" seemed to be the depth limit—the tool's speed burned the bit.

In grinding, the sustained high speed of the new motor makes better use of the abrasive, removing metal with less wheel wear. Mounted on a lathe, the new Moto-Tool is a light-duty toolpost grinder.

The Moto-Tool motor. Limiting the old tool was a unicoil motor field—a U-shaped magnet core with a single winding on the crossbar. Far less efficient than a dual-coil field because the winding was so far from the desired flux area, the unicoil field was necessary to keep the tool size down.

The new motor has no field windings at all, but two arc-like magnetized segments of barium ferrite, which has the highest resistance to demagnetization of any material known. There being no windings, no electromagnetic field failures can occur, no heat is generated in the field magnet, and the size of the field magnet is reduced.

Continued

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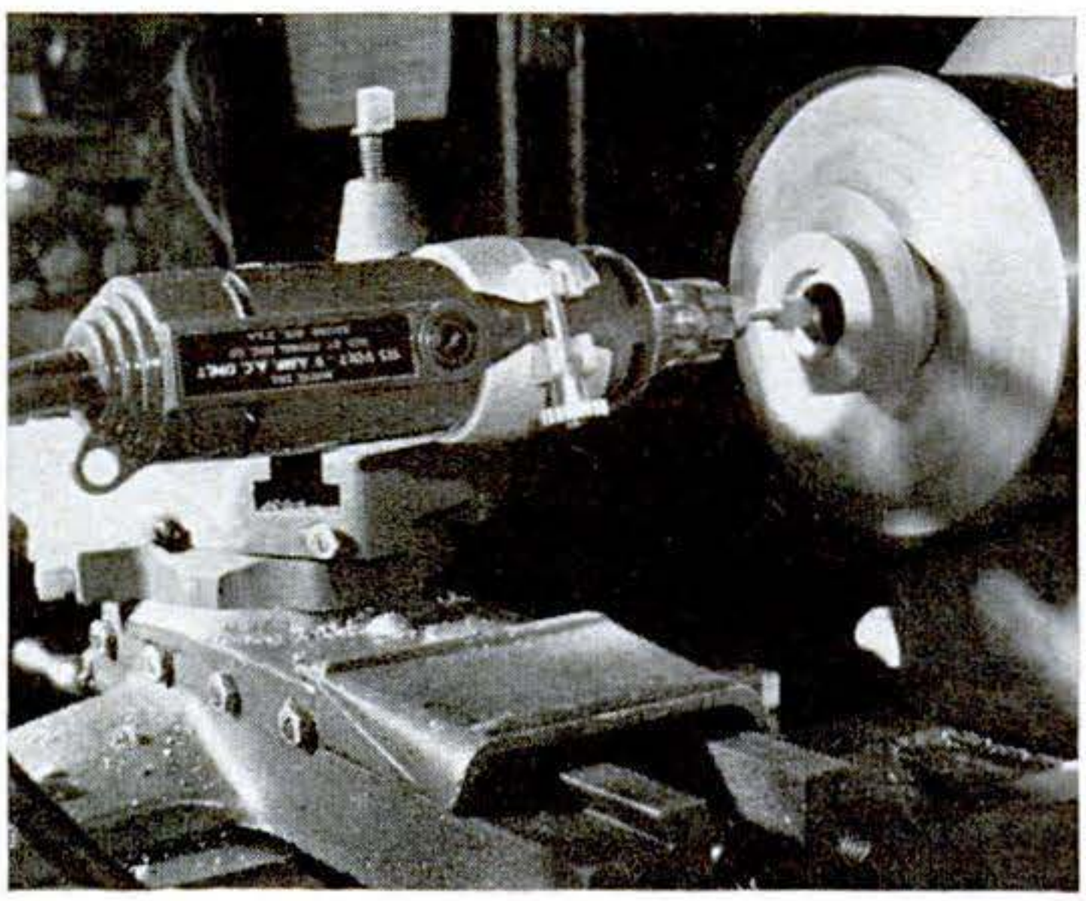
But there is still greater advantage to the p.m. (permanent-magnet) field. In the series motor, as a load slowed down the armature, its winding drew more current. That increased current had to flow through the field coil, too, making the field stronger. The strengthened field further slowed down the armature.

The permanent-magnet field is constant and independent of armature current. Under load the armature draws more juice, but field strength remains the same, so a balance between torque requirements and current demand is more readily attained. The result is that the speed curve of a p.m. motor is flat, dropping much more slowly than that of a series motor.



Clamped to the toolpost of a metal-turning lathe, the new Dremel model 280 has ample power for light grinding with moderately sized wheels.

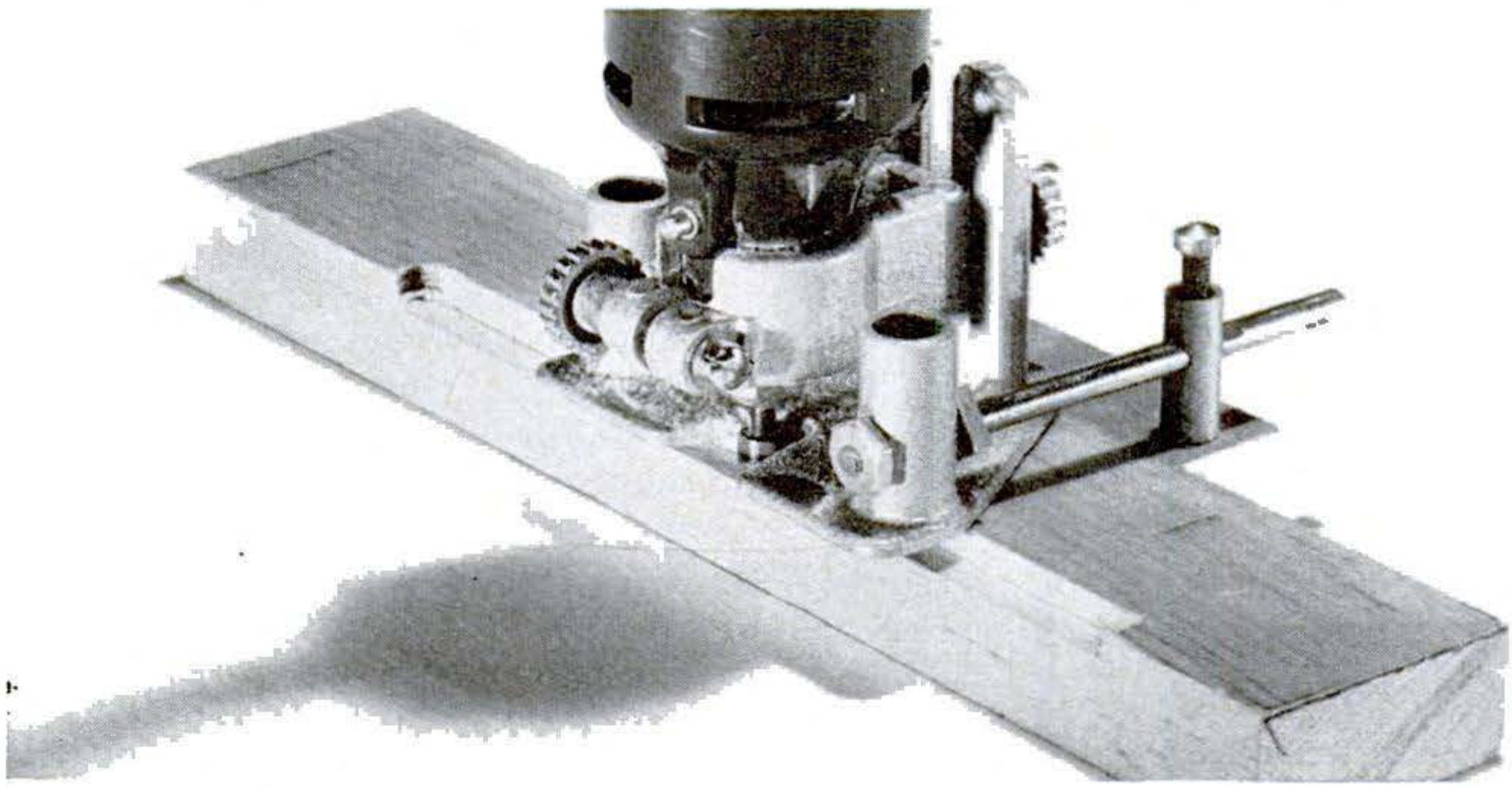
Energized by 60-cycle AC, the old unicoil field reversed polarity 120 times a second. As the same current flowed in the armature, its polarity altered in exact time with the field's. Relative polarity was always correct, and the motor ran.

But the polarity of a p.m. field is constant, so an armature powered by AC would be reverse polarized with relation to the field during one half of each current cycle. In the new tool, therefore, household AC is rectified to direct current by four glass-encapsulated diodes, potted in epoxy and connected in a full-wave bridge circuit. Delivering more power, the p.m. motor takes more current, too. It is rated at .9 amp.

TV static reduced. The new armature has eight poles, and the commutator 16 bars instead of five. There is, therefore, less voltage difference between adjacent bars, and less arcing as each passes under the brushes. Brush life is four times as long as formerly, and there is no TV interference where signal strength is good.

The first major change in the Moto-Tool in 35 years, the new motor is the brainchild of Albert Dremel's son Robert. Outwardly, it's hard to tell the new Moto-Tool from the old. The most obvious difference is a hex collet nut instead of a knurled one. The Dremel people decided you'd better tighten the tool in with a wrench instead of the fingers, to take advantage of all that extra torque the new model packs. PS

Using a shaper attachment as a router base, you can do good light-duty routing with the new Moto-Tool. An improvised fence and homemade 1/4" bit made a 3/16"-by-1/4" rabbet in three passes.



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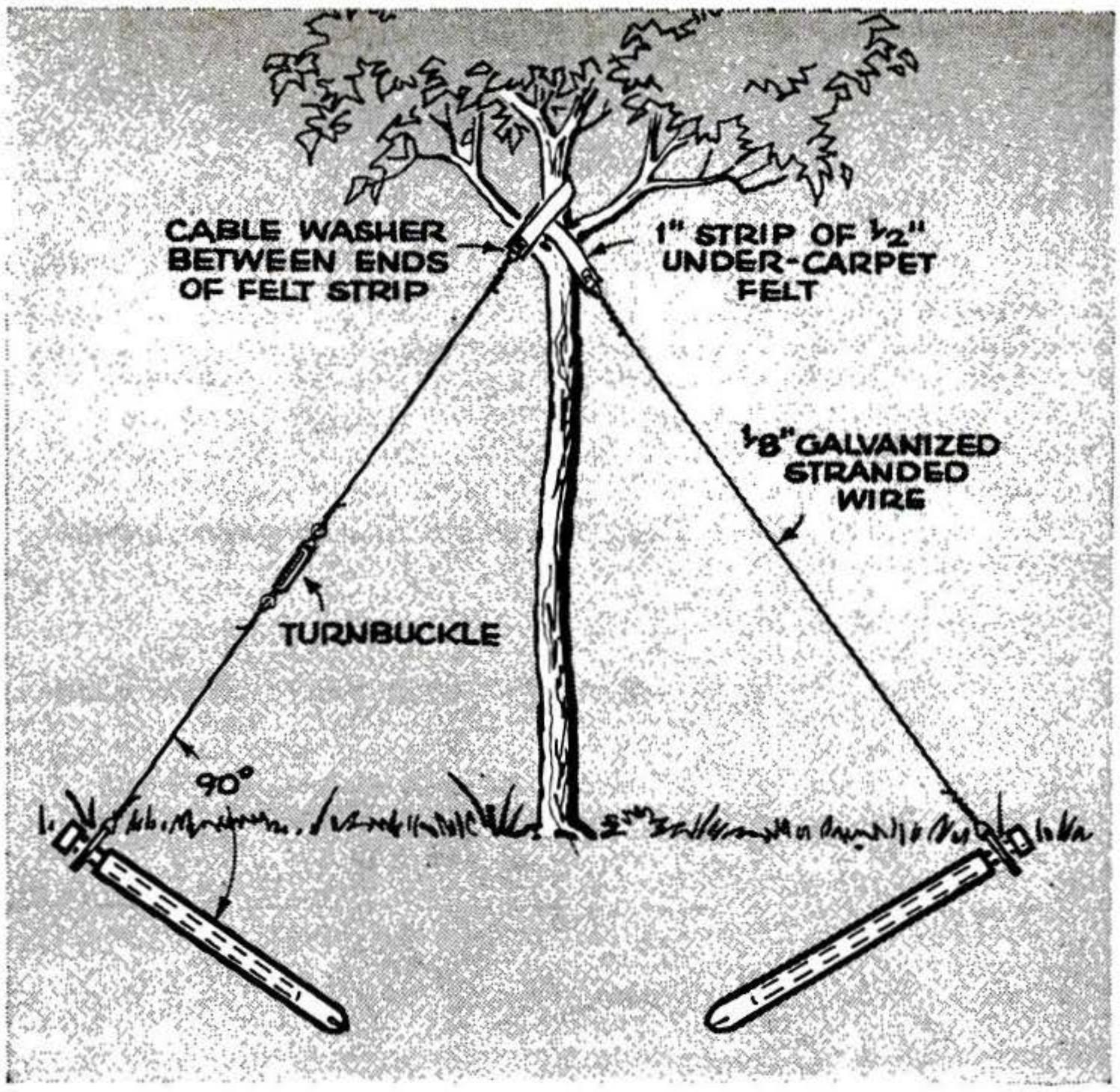
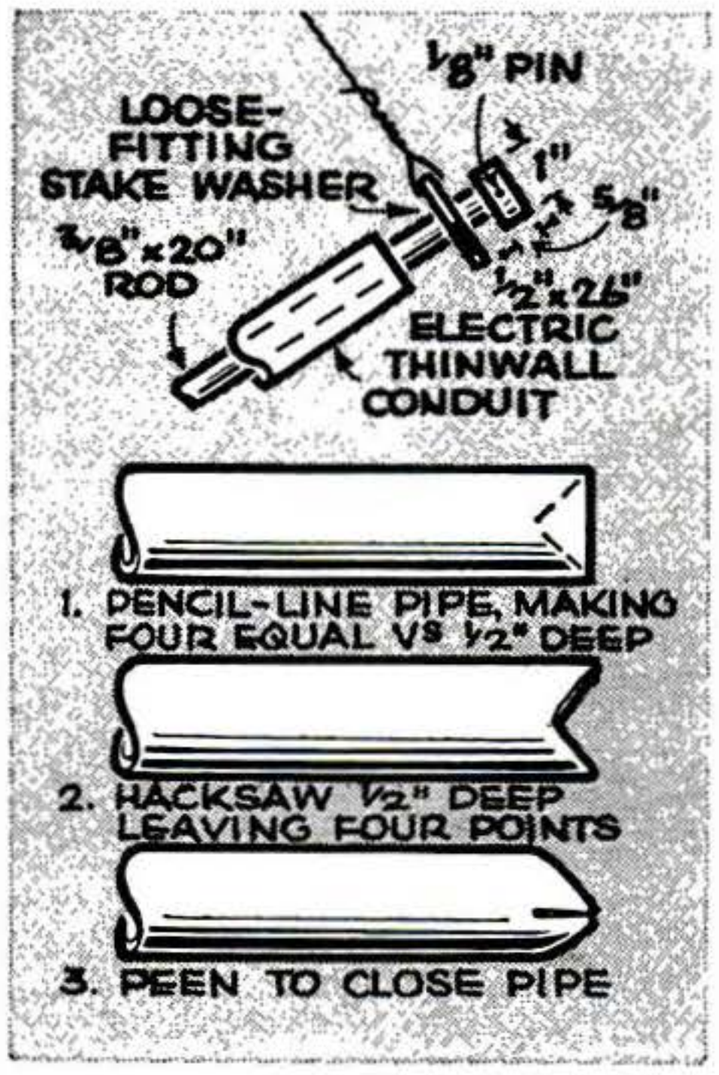




Guy-line stake lifts out when you mow your lawn

You can dismantle and reset this tree guy-line in seconds when you mow. It's a ⅜" steel rod sliding inside a length of ½" conduit. Notch one end of the conduit to form four points and hammer them into a tapered, closed end. Bore a ⅝" length of 1" cold-rolled stock to receive the ⅜" rod. Slide it onto the ⅜" rod, drill, and secure with a peened pin. Drive the assembly into the ground until the top is flush. A loose washer around the sliding-rod stake holds the wrap-around, soldered ⅛" cable. Carpet underlayment protects the tree limb.

GEORGE KOLB, Albuquerque, N.M.

A tool that comes in a can

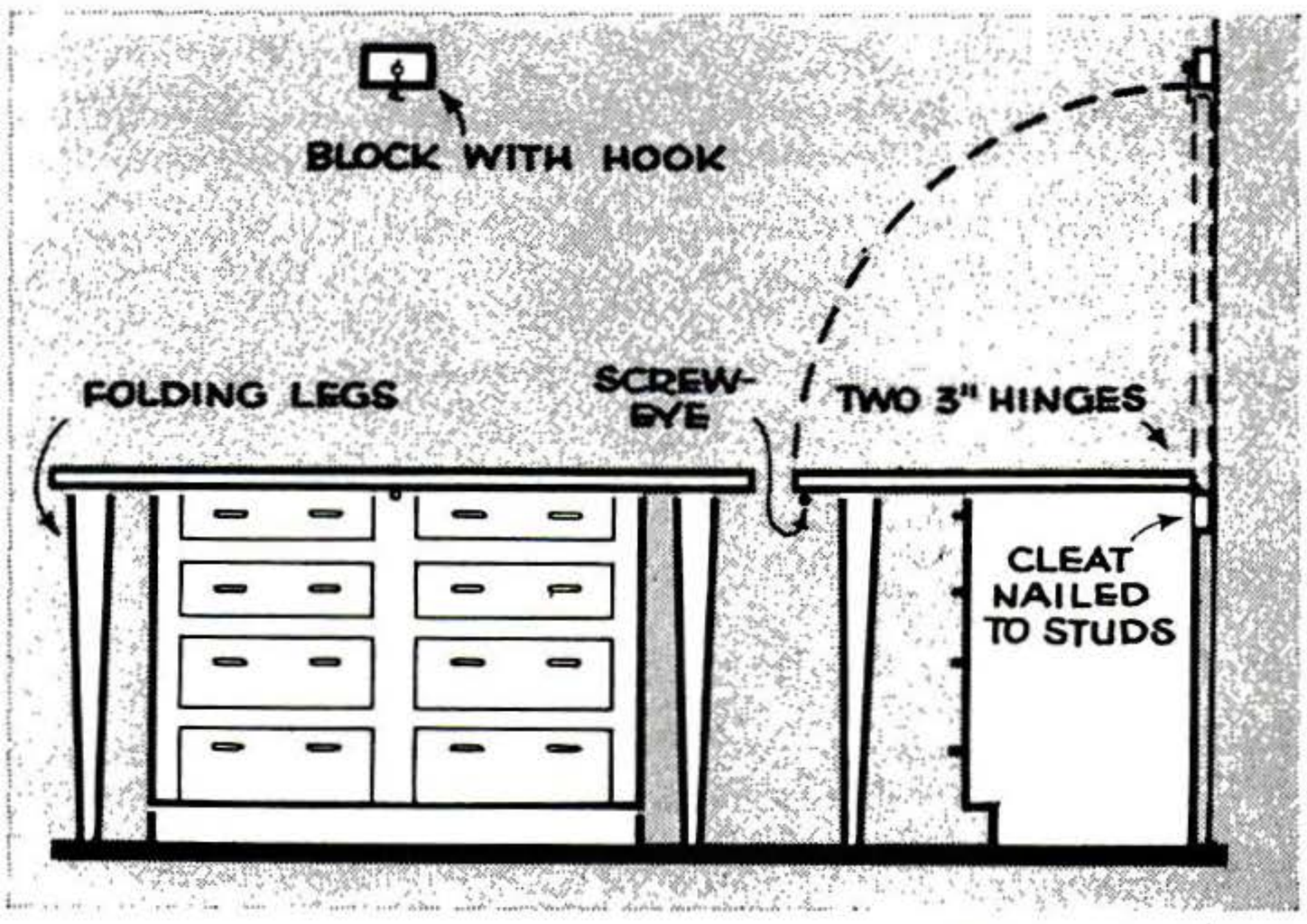
No workbench should be without a can of silicone spray. Sprayed on cutting edges, it makes cutting easier and lengthens edge life. On a handsaw, it stops ¼"-plywood chatter. When installing slides and other moving hardware, use it in place of oil. Spray the snow shovel to keep snow from sticking, and the insides of the kids' galoshes so they'll slide on with less tugging.

HARRY VERNON, Brooklyn, N.Y.

Fitting two workbenches in the space of one

If your shop is short on space but long on projects, try this trick: Keep your woodworking bench clean by hinging an old door above it. Lower the door for painting, soldering, and other messy jobs; when finished, flip it into the storage position, held in place with hook and eye. To support your second bench, use folding legs, hinged two-by-twos, or pipe and flanges.

WILLIAM WALTER
Floral Park, N.Y.



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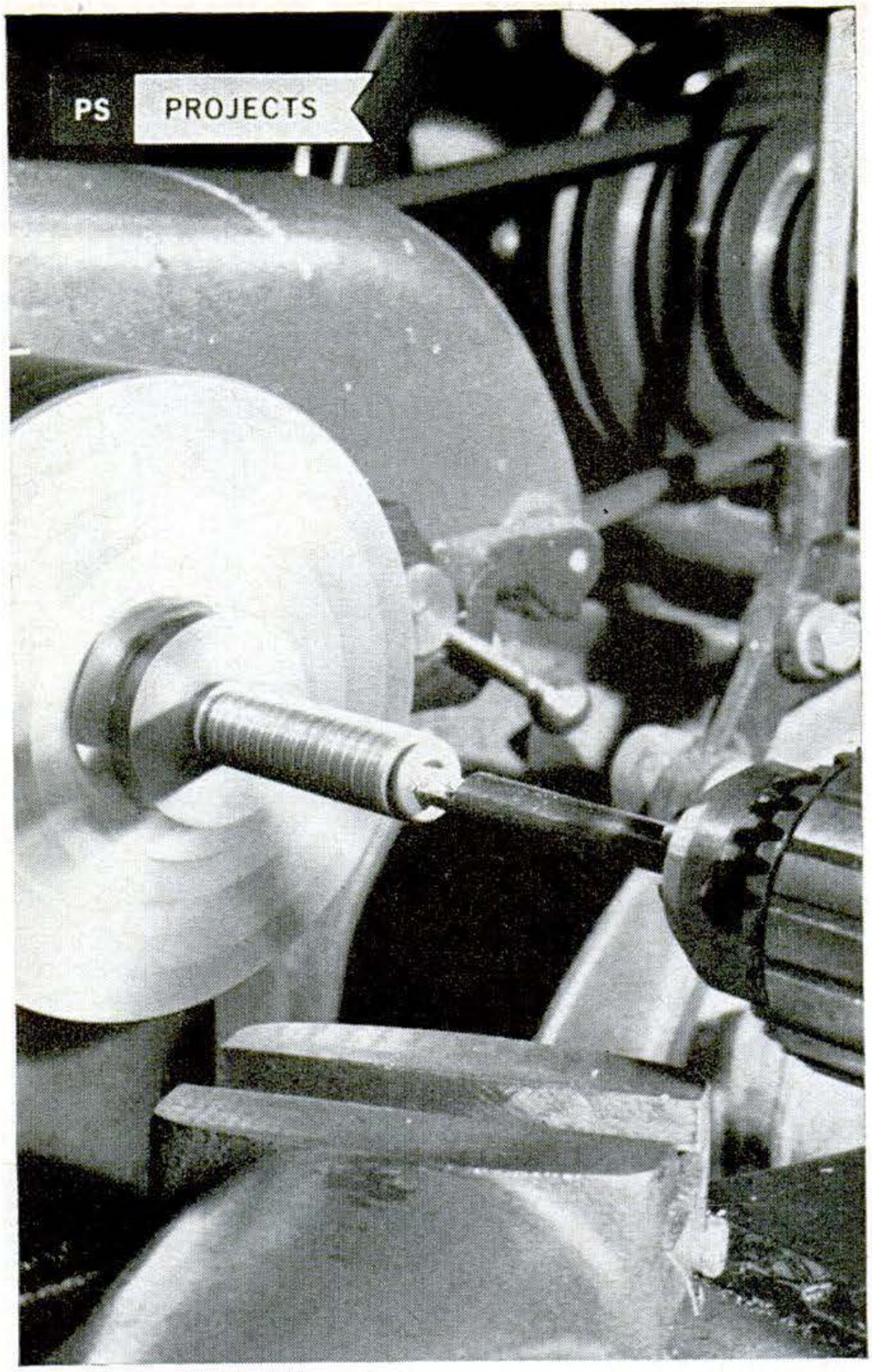


How to

Lopsided drill with only one cutting edge is easy to make and handy to have

By HARRY WALTON

What a D bit can do is shown here. Following a pilot hole, the 5/16" bit above made a true, accurately sized hole through 3" of hex steel. The bit is capable of drilling holes as deep as itself.

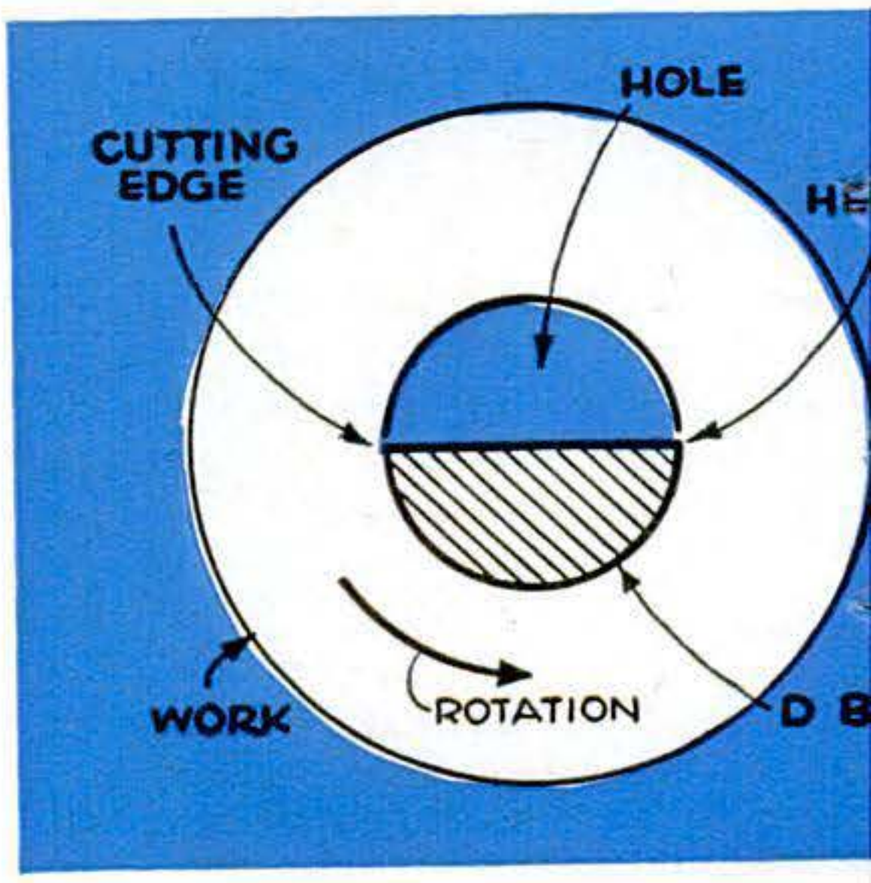
Ordinary D bit is shown at left. The round-end bit will leave a domed end inside hole. Holes for taper-pin valves are made with tapered D bit. V-nosed bit at right can be used freehand.

A lopsided drill with only one cutting lip—that's a D bit. It will drill holes dead true, exactly its own size, as long as itself. It will even straighten smaller holes drilled crooked.

All that D bits will cost you is a little steel and a bit of work. Hardly anything with an edge is easier to make, and you can run up any special size needed.

The deeper the hole, the more prone a twist drill is to wander, even when used in a lathe. A D bit is much stiffer for its size. Its heel bears against the wall of the hole, giving the cutting tip positive guidance. Really a one-size precision boring bar, a D bit should be used in the lathe or drill press.

Forming a D bit. Drill rod is



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Machine Your Own D Bits

the choice material: It comes precision-ground to size, is easily hardened. But you can use mild steel, if you wish, by case-hardening it.

Cut a piece the diameter of the hole wanted and 1″ longer than its depth. Saw, file, mill, or grind a flat from three to eight diameters long on it, and slightly more than half the diameter thick.

Finish the flat on an oilstone, holding it down hard as you rub it along. Check with vernier calipers or a micrometer to make the D section one half the diameter plus a thousandth for every 1/10″ of diameter. Without this allowance the bit will drill oversize.

Play a torch flame on the back of the flat until it is cherry red to the tip. Quickly drop the entire bit vertically in cold water. Brighten the back of the flat with emery cloth, apply heat an inch or two from the end, and watch the tempering colors creep toward the tip.

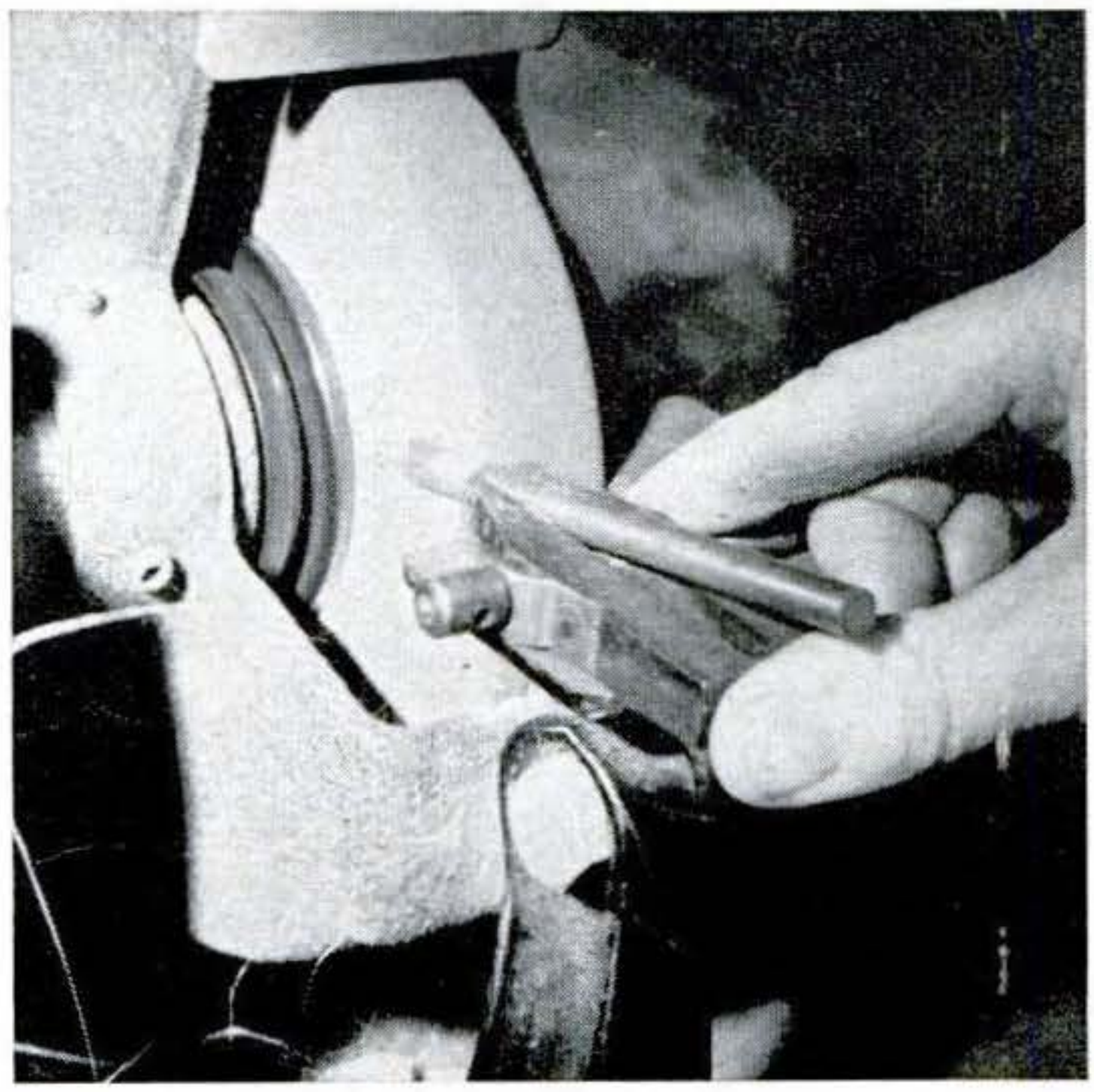
Just before a gold-straw color reaches it, quench again. A file should skate over the hardened metal without biting in.

Grind the end as shown. Stone carefully at the same front and top angles. Remove burrs from the side edges by rubbing the bit, shank and all, on an oilstone. Deburr the rounded bottom of the tip. Stone a tiny radius on the forward corner.

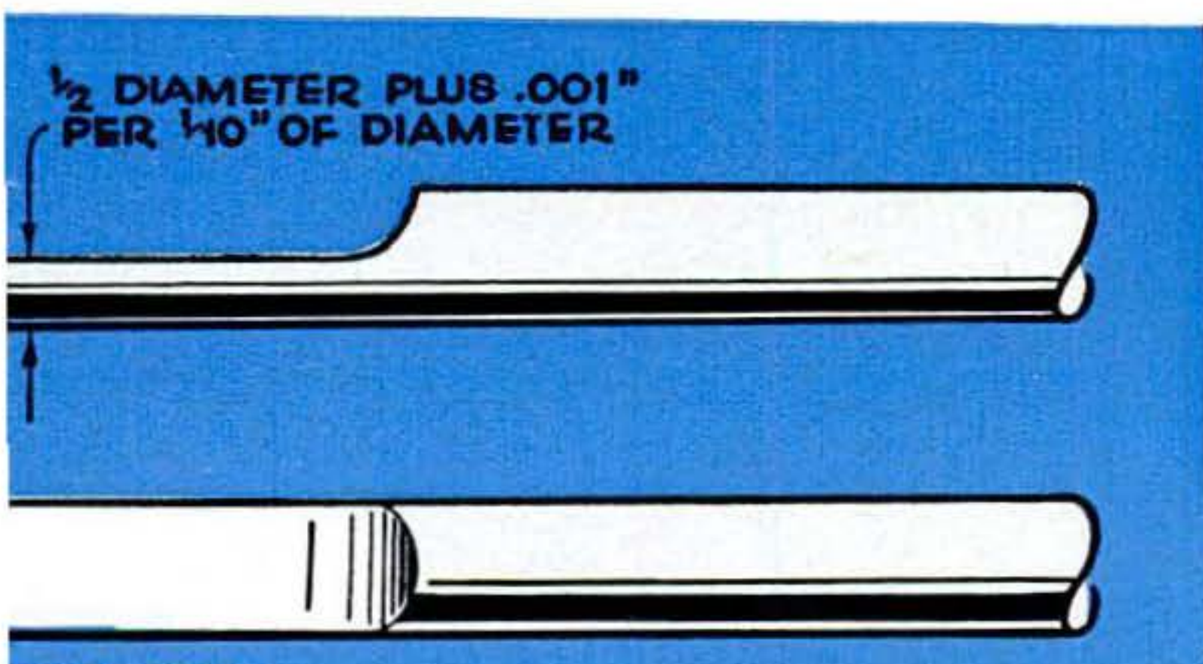
To drill in lathe. First see that headstock and tailstock are aligned. Drill a starting hole the size of the D bit, deep enough to let the heel enter. With the lathe at a medium speed, feed the D bit slowly. Use a lubricant. Back the bit out often to clear out chips; once the flat has fully entered, the chips have no place to go and may jam hard enough to seize, ruining work and bit. Squeaking is a sign of impacted chips.

Up to 3/16″ diameter, a D bit can drill its own way. For bigger ones, drill a pilot hole. The larger this is, the faster the D

Continued



To grind the flat, stock may be fixed in a machinist's clamp and fed to the left side of the wheel. Laid on the tool rest, the clamp realigns the flat each time the work is removed for dipping in water.



Choose your size—large or small. In brass, D bits can work without a pilot hole, but they should be started in one deep enough to let the heel enter. The longer the flat, the more chip clearance, but a short flat gives more rigidity.

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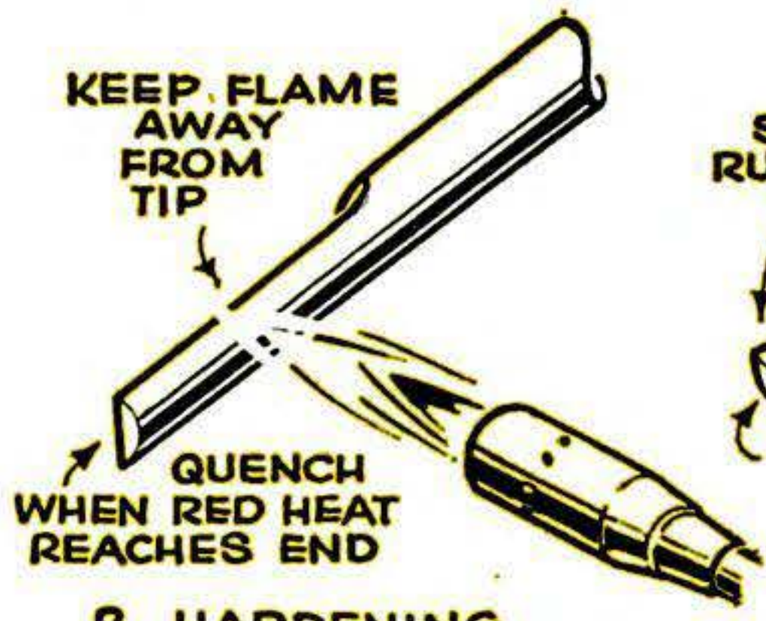
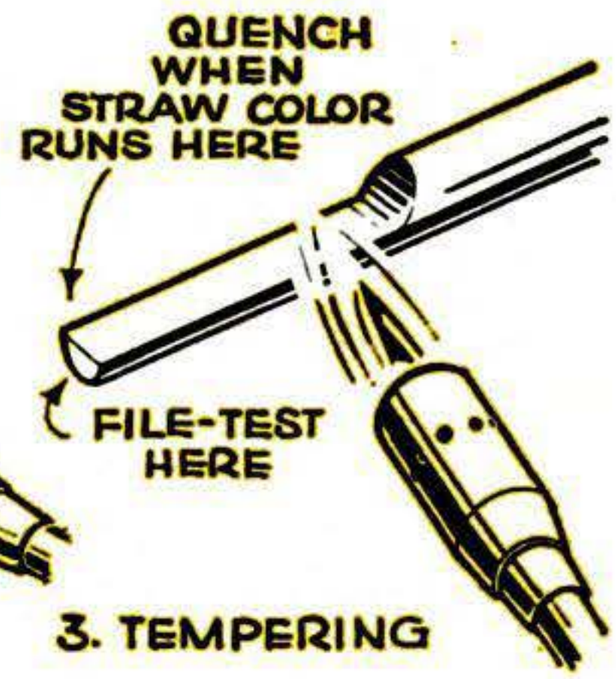
Some of the steps in machining your own D bits

1. FORMING FLAT

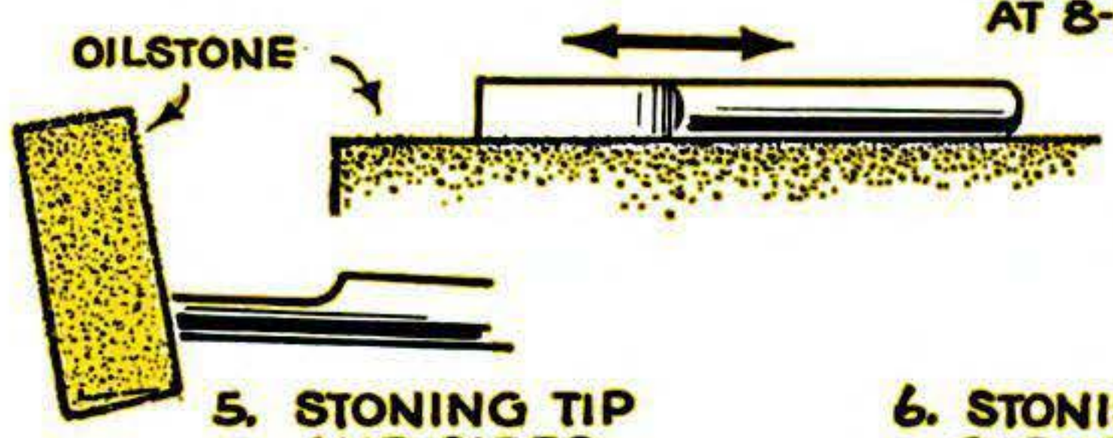


2. HARDENING



3. TEMPERING

4. FORMING END



5. STONING TIP AND SIDES

6. STONING CORNER

bit will feed, but for deep holes leave enough metal for the D bit to true up runout. Avoid overheating in aluminum or brass; on cooling, the metal may shrink the hole, binding the bit.

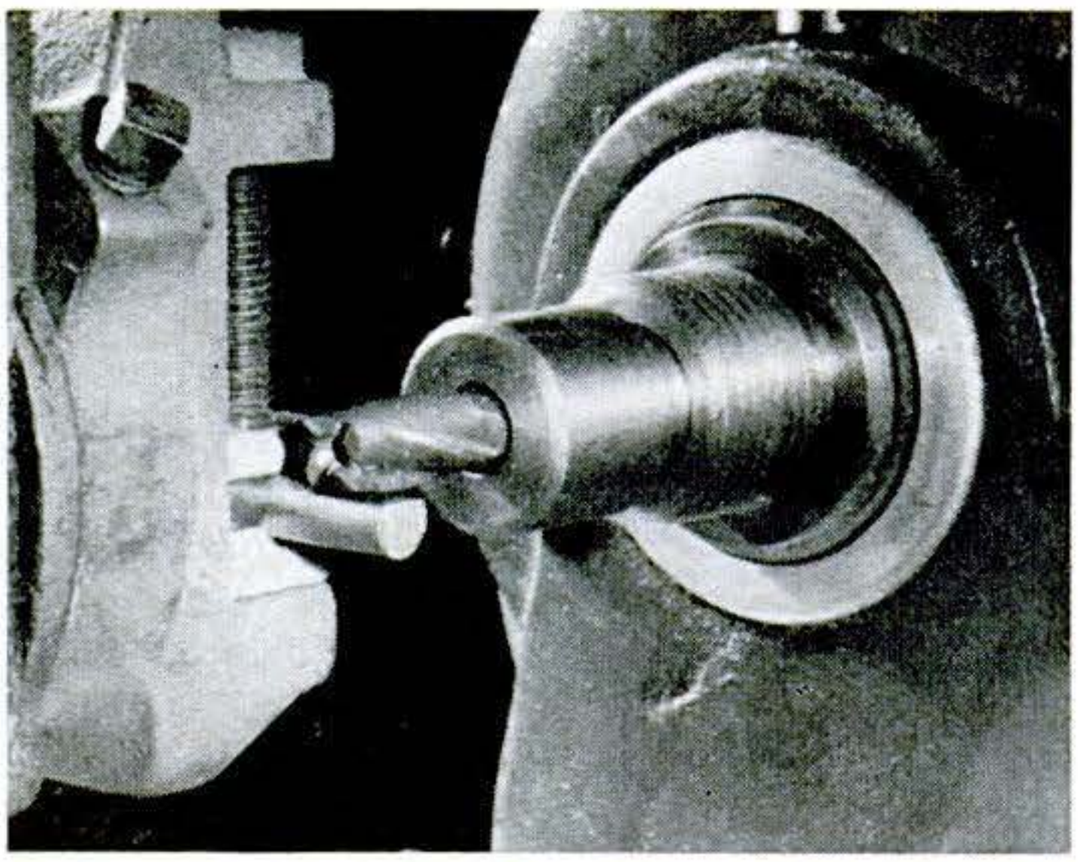
On the drill press, tighten the table securely and clamp the work to resist the side strain of the one-lipped bit.

In case of trouble. If a D bit suddenly stops cutting in a deep hole, jammed chips or overfeeding has probably heated the tip enough to draw its temper. If a bit drills undersize (it will jam as soon as it enters beyond the flat) the flat is too far above or below the centerline, or the edges may be dubbed off.

A D bit will drill oversize if the tailstock chuck is slightly forward of the lathe centerline, if a drill-press chuck runs out of true, or if there are burrs on the trailing edge of the flat.

Special D bits. Turning the shank down slightly smaller than the D section will reduce friction in long holes. A better finish may be obtained with a square tip rounded off at both sides, but this bit will work more slowly and requires a pilot hole. The center-pointed D bit shown forms a countersink at the bottom of its hole, and in a pinch can be used freehand. Accurate tapered holes (for drive pins and taper-plug valves) can be made with a D bit that you have turned to the required taper angle.

For resharpening, it's best to grind or stone the end slowly, leaving the flat its original height. PS



Flats can be filed, ground, or milled on a lathe with a milling attachment. With above setup, cutter was lowered at the end of desired flat and the stock backed away, feeding cutter to end of piece.

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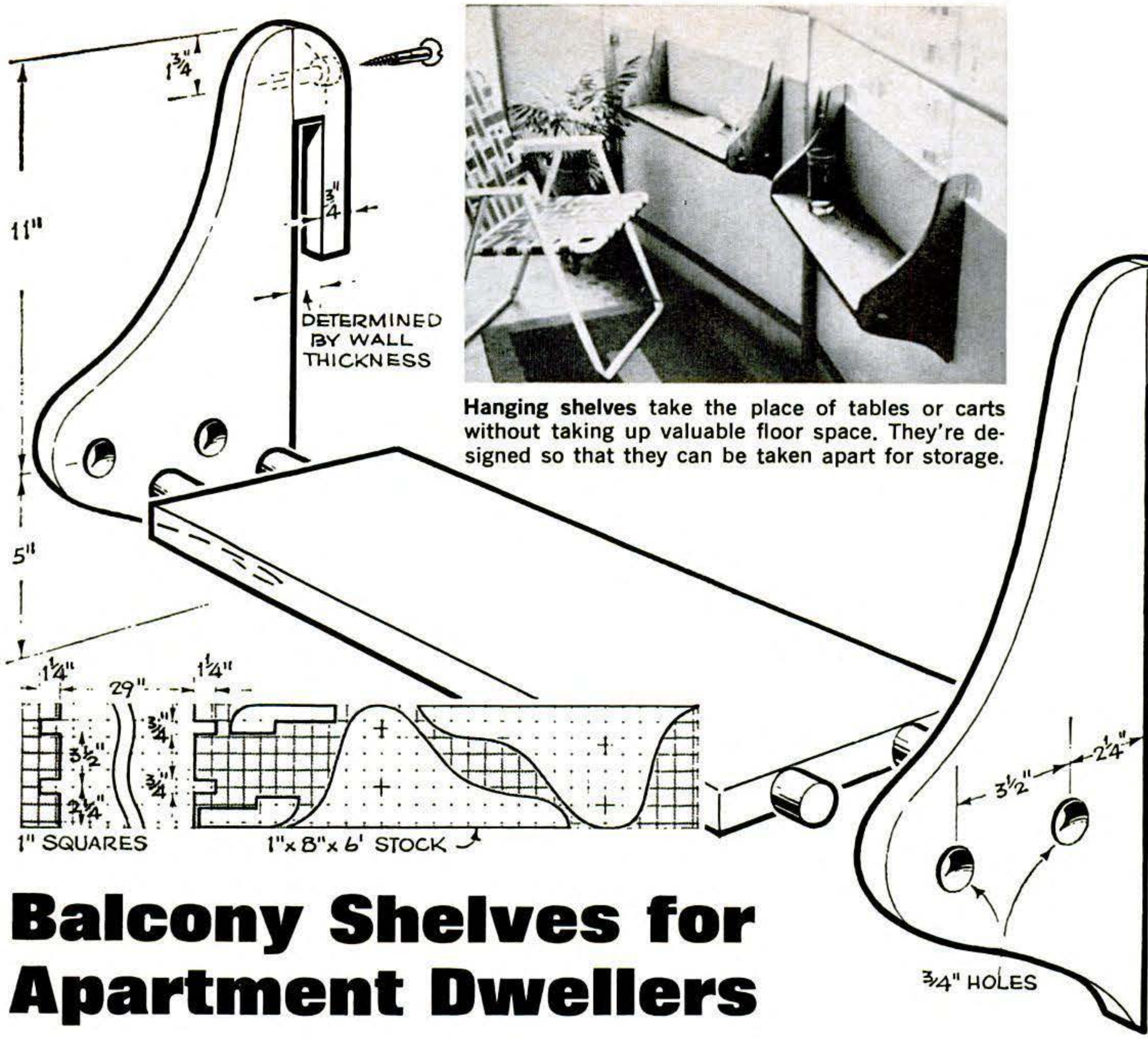

Hanging shelves take the place of tables or carts without taking up valuable floor space. They're designed so that they can be taken apart for storage.

Balcony Shelves for Apartment Dwellers

If you live in a high-rise apartment, as I do, you probably spend a good deal of time out on the balcony during the warm months. There's never enough room for end tables or snack carts, so finding a spot for drinks, ashtrays, and the like can be a problem. I solved this problem by building take-apart shelves that can be stored flat when they're not in use.

The shelves in the photo were made of redwood, but cedar or pine would do just as nicely. To achieve a rustic effect, the tenons are peg-shaped and protrude ½" beyond the sides. For the best-looking job, select the lumber carefully. Pick a straight piece with an attractive grain, free of knots.

Building is simple. Outline the parts and make the cuts with a saber saw. Hint: After cutting the first side, use it as a pattern for the second. Use the same procedure for cutting the extensions. The notch on the extensions must be custom-cut to fit your balcony wall. Use the wall thickness, plus ⅛", to determine this cut.

Drill the ¾" holes in the sides and, to avoid splintering when the bit breaks through, use a backup board. Cut the shelf as shown, and round the tenons to fit the holes. The extensions are attached with screws. Countersink the heads so they will be out of sight. When joining sides and extensions, apply a dab of glue to prevent twisting.

After sanding, finish by applying a coat of clear furniture oil—such as Danish oil. Follow this with a light coat of liquid wax, to protect the shelves from stains and spills. Hang them up, and bring out the guests.—*L. O. Rexrode.*

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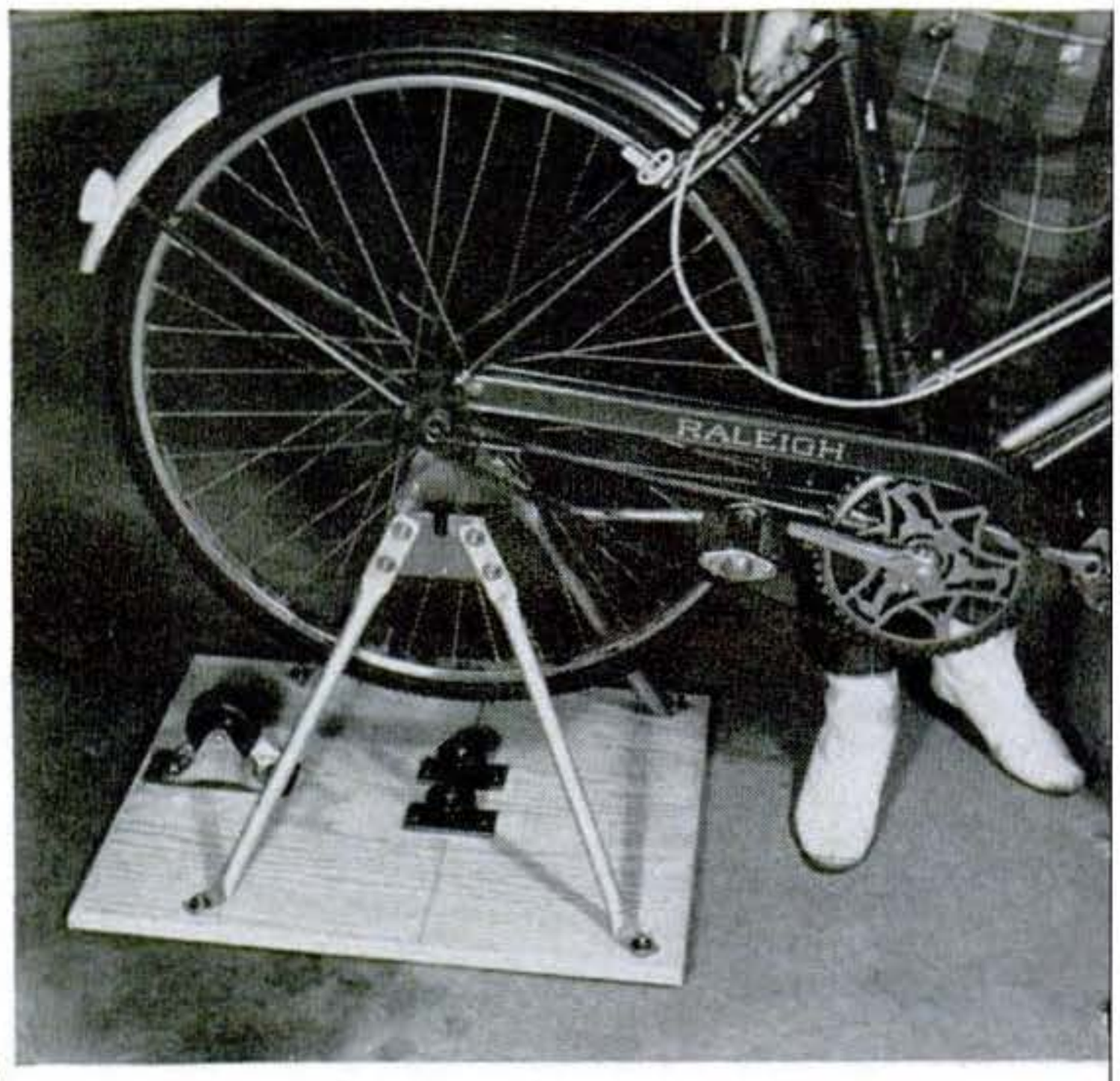
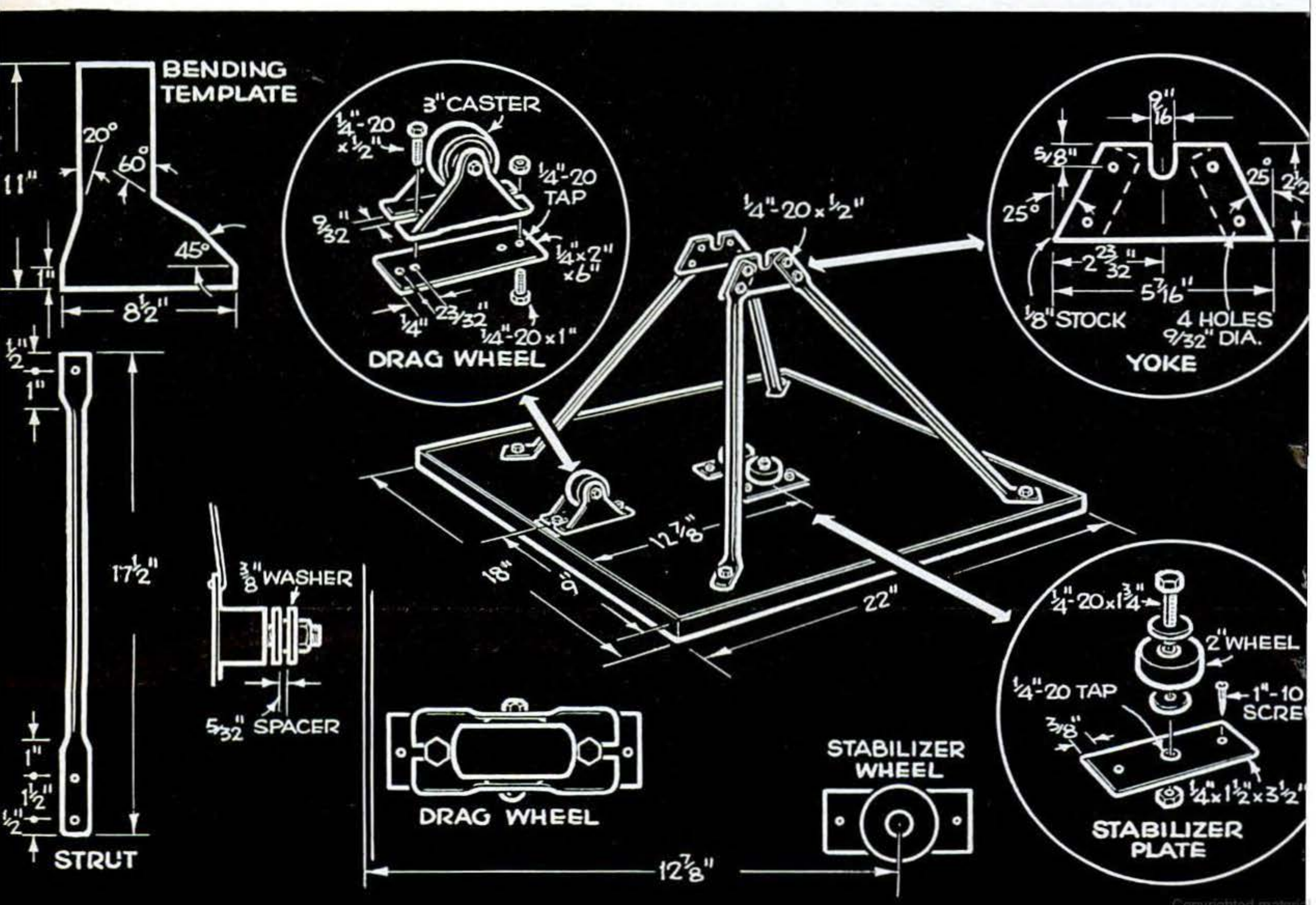
Bike Exerciser



Switching is easy with this design. No tools are needed to convert from exerciser to street use, or vice versa. Unique design of the slotted yokes and permanently mounted spacers on the axle enable you to use bike outdoors without dismantling device. This one is for 26" bike; vary strut lengths for other sizes.



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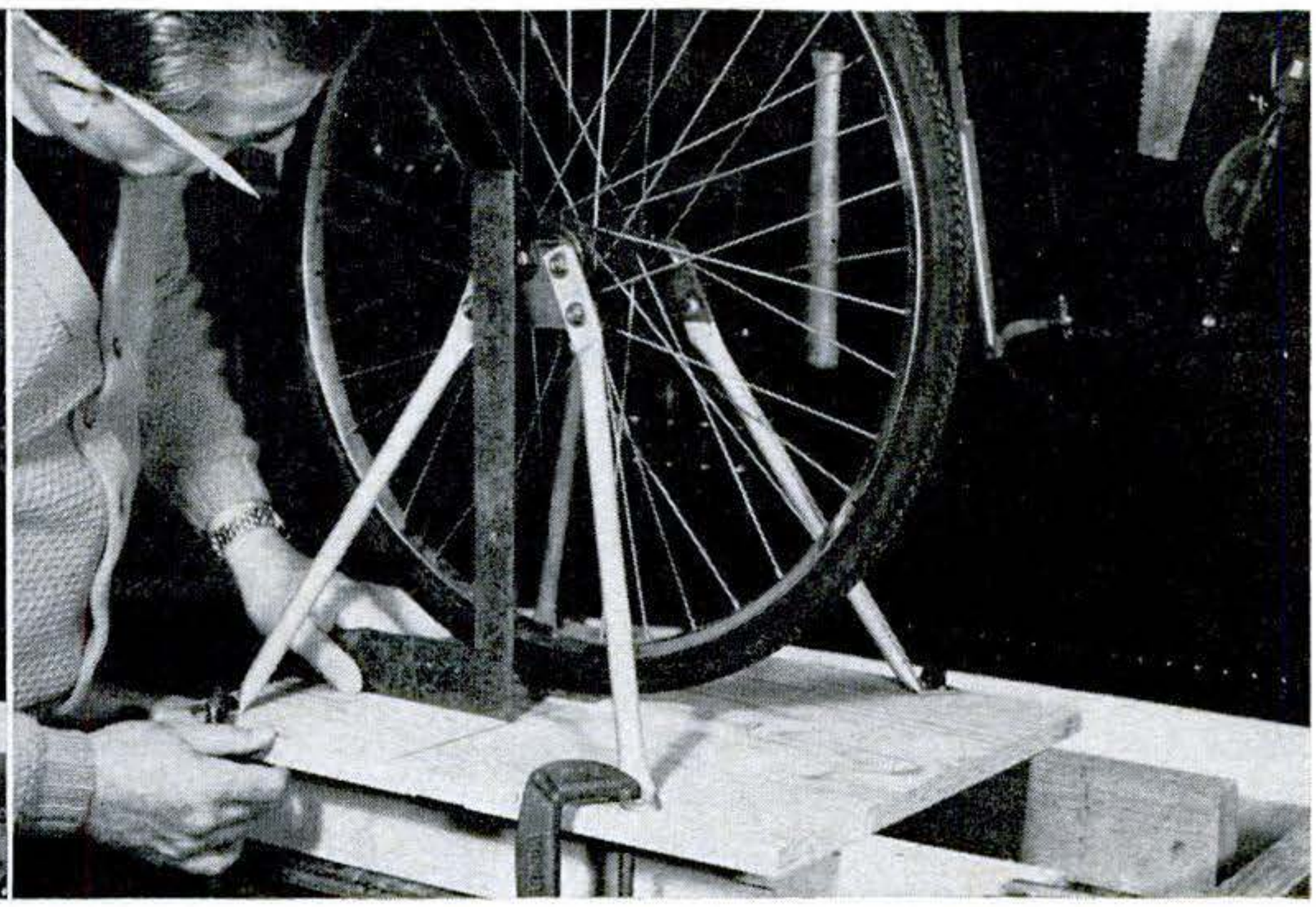
You Can Build

Cardboard template simplifies bending the struts. Design of template is shown on the sketch.



To find strut location, the assembly is moved around until the rig is positioned. A square helps here.

With this easily constructed stand, you can use your bicycle indoors in foul weather, as well as on the streets

By R. D. CORWIN and M. E. DUCHOVINER

Bicycling is a great way of staying in shape. But during the winter months when we need the exercise most, the bike often can't be used. This stand is designed so that the bike is not permanently attached; and that means 12 months of cycling, indoors and out. You can build it for less than $8.

Start by cutting the tubing and flattening the ends in a vise. Flatten the first end, roll the tubing 45 degrees, and do the other. Bending comes next, and using a template simplifies this step. There are right- and left-hand struts to each pair, so make the bends in the right direction. To be sure the holes in the yokes and struts line up, drill them with the pieces clamped together.

To assemble the stand, clamp the yoke and strut assemblies to the base in just about their final location. Drop the rear wheel into the slots and place a piece of ⅜″ scrap under the tire. Move the struts around until the tire is over the centerline; use a square to make sure the axle is over the second line. The wheel axle must be parallel to the base, too; so measure from both ends of axle to base to be sure. Once these three points are checked out, the struts can be permanently attached to the plywood base.

The stabilizer and drag wheels are placed on the base so that they just touch the bike tire. The weight of the rider will bring the tire into full contact with the drag wheel. The drag wheel is rigged so drag tension can be changed to suit the rider.

All assembly to the base is from underneath, with bolt heads countersunk. When setting the wheels, mark and drill holes in the base to provide clearance for the bolts. The spacers, which are left on the bike permanently, are made from ¼″ pipe which is drilled out to fit the axle. To speed assembly, and for easier handling, work with the rear wheel off the bicycle.

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How to Put Down an Instant Lawn

Make-believe grass of massed plastic fibers looks and feels like the real thing underfoot. You can use it almost anywhere outdoors

By ROSARIO CAPOTOSTO

Tired of mowing grass? You no longer have to. You can put down an artificial lawn that never needs a bit of maintenance. Each square foot contains what looks like 7,000 individual blades of real grass. The stuff is molded of a tough plastic material.

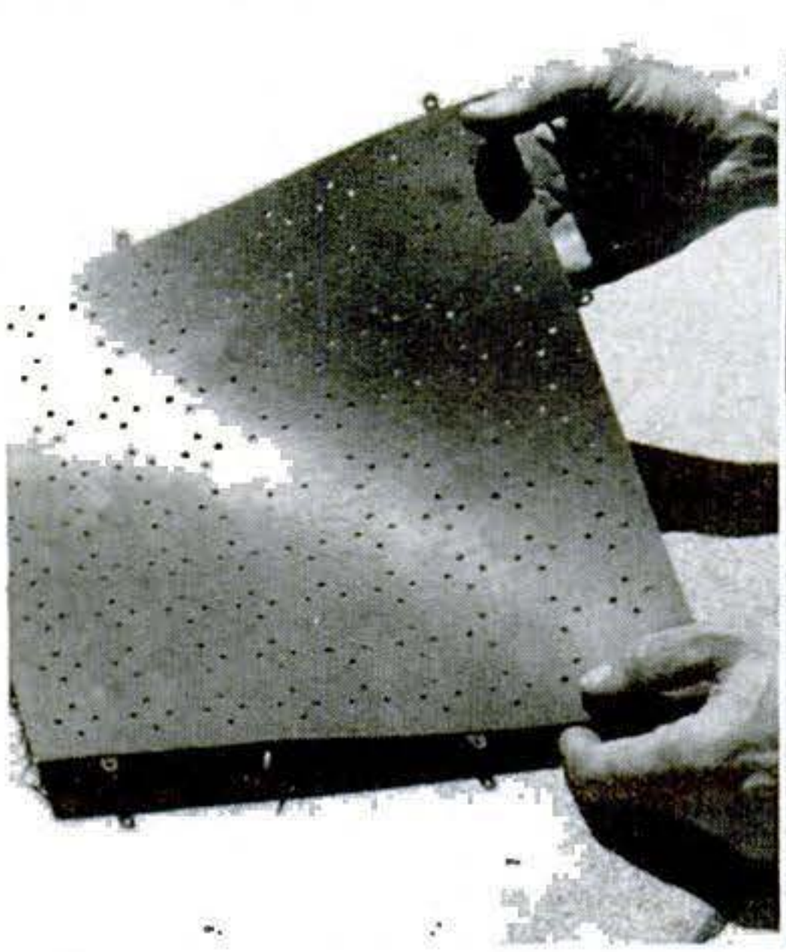
Besides small lawns, the maker recommends Perma-Grass for terraces, sundecks, patios, and walks around swimming pools. You can also use it, either indoors or out, as a putting green—or as a skidproof surface on the deck of a boat.

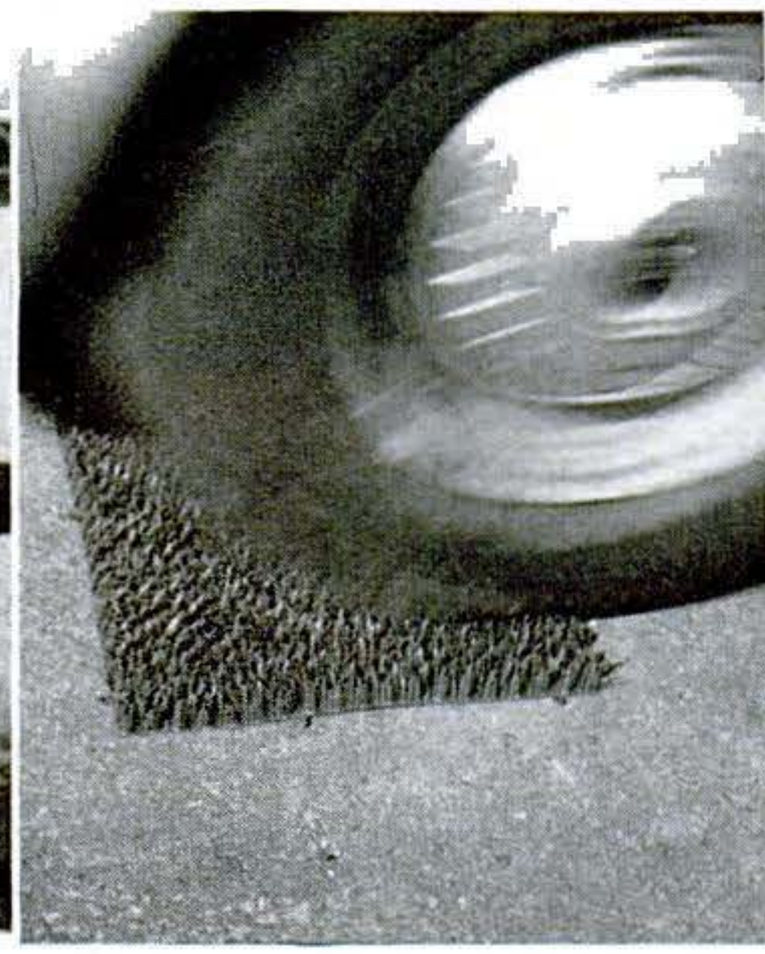
I found the make-believe grass a boon on the sun decks of my new home. In warm weather the deck was virtually useless because tar oozed from the joints of the roofing and sharp heels and furniture legs plunged into the soft surface.

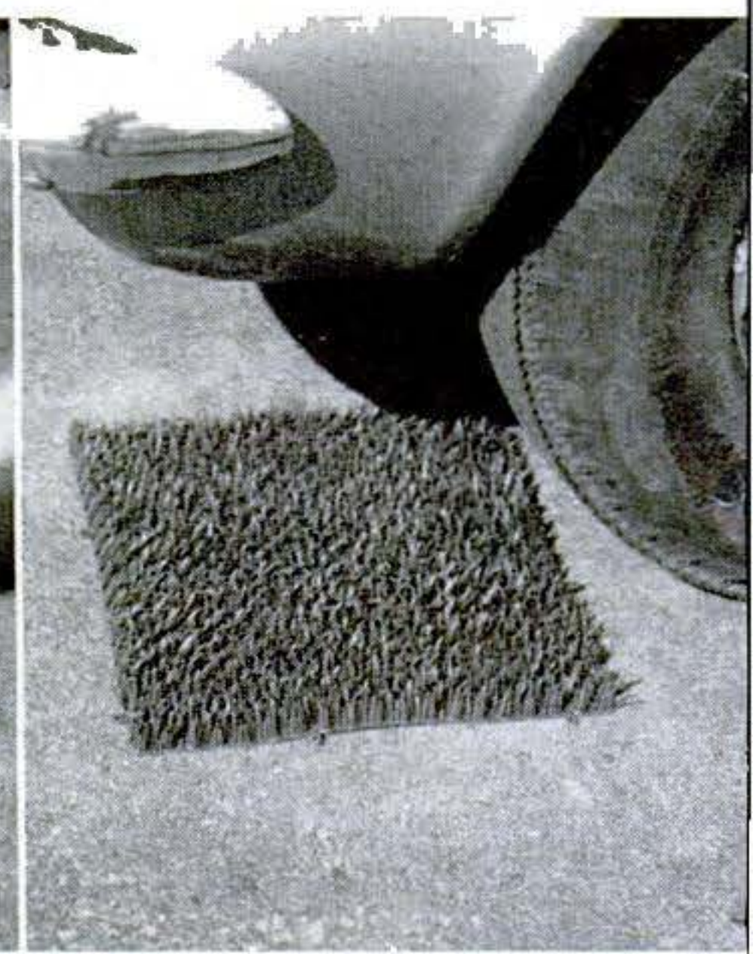
The manufacturer had suggested that the squares be locked together with the built-in tabs and pegs and the resultant mat allowed to lie in place like a rug. But I didn't find that satisfactory. I decided to put down the grass carpet permanently, using Barclay 850 waterproof adhesive. One cartridge is enough for about 24 squares of the "grass."

Many large department stores handle Perma-Grass. If yours doesn't, write to the maker—OBI, Inc., Ridgefield, N.J. 07657. The price is $1 a square foot.

How tough is the new artificial grass? Will it stand up?







Author developed his own tests to get some answers about artificial grass. After four hours in a home freezer, he found sample still flexible (left), an important characteristic for outdoor use. He then drove his car back and forth over cold sample dozens of times, repeated this later with another sample left for hours in hot sun. The punishment produced no ill effects. The "grass" came back to original shape.

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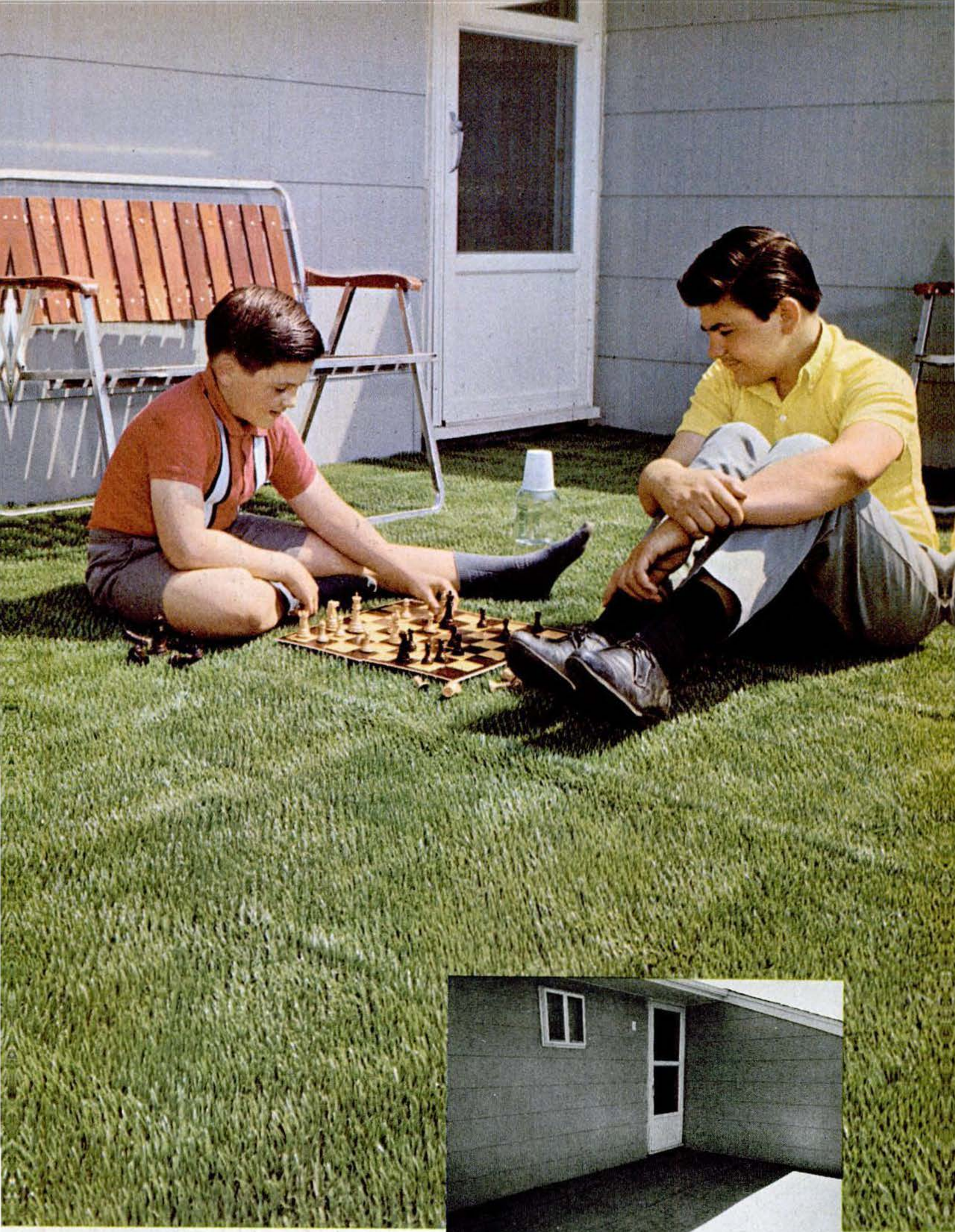

Chess on the greensward is one way of making life more pleasant on the second-floor sun deck of the author's home since he put down the make-believe grass. Original surface was tar paper. *Continued*

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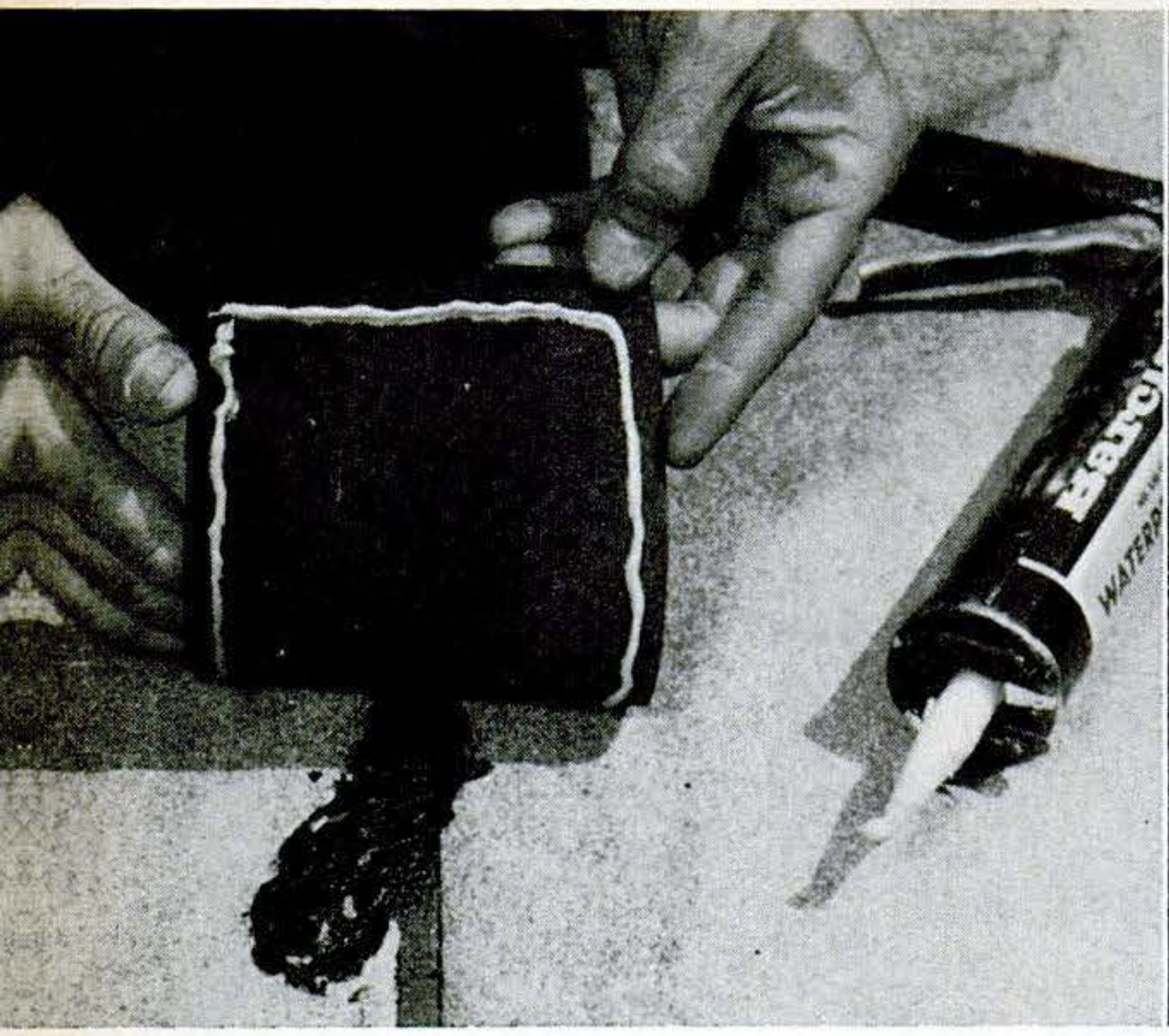
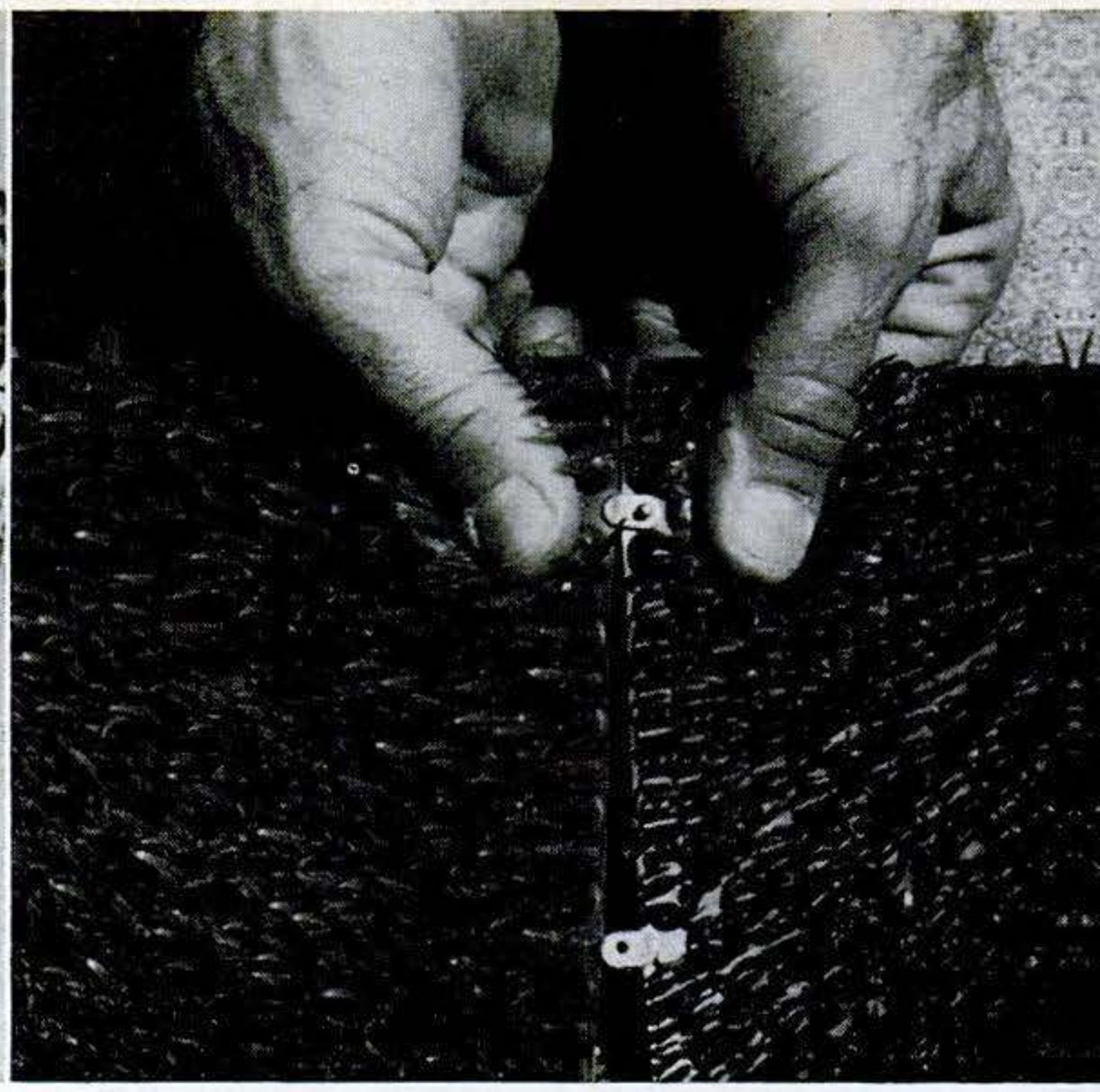
Highlights of installing a plastic-grass carpet on a sundeck

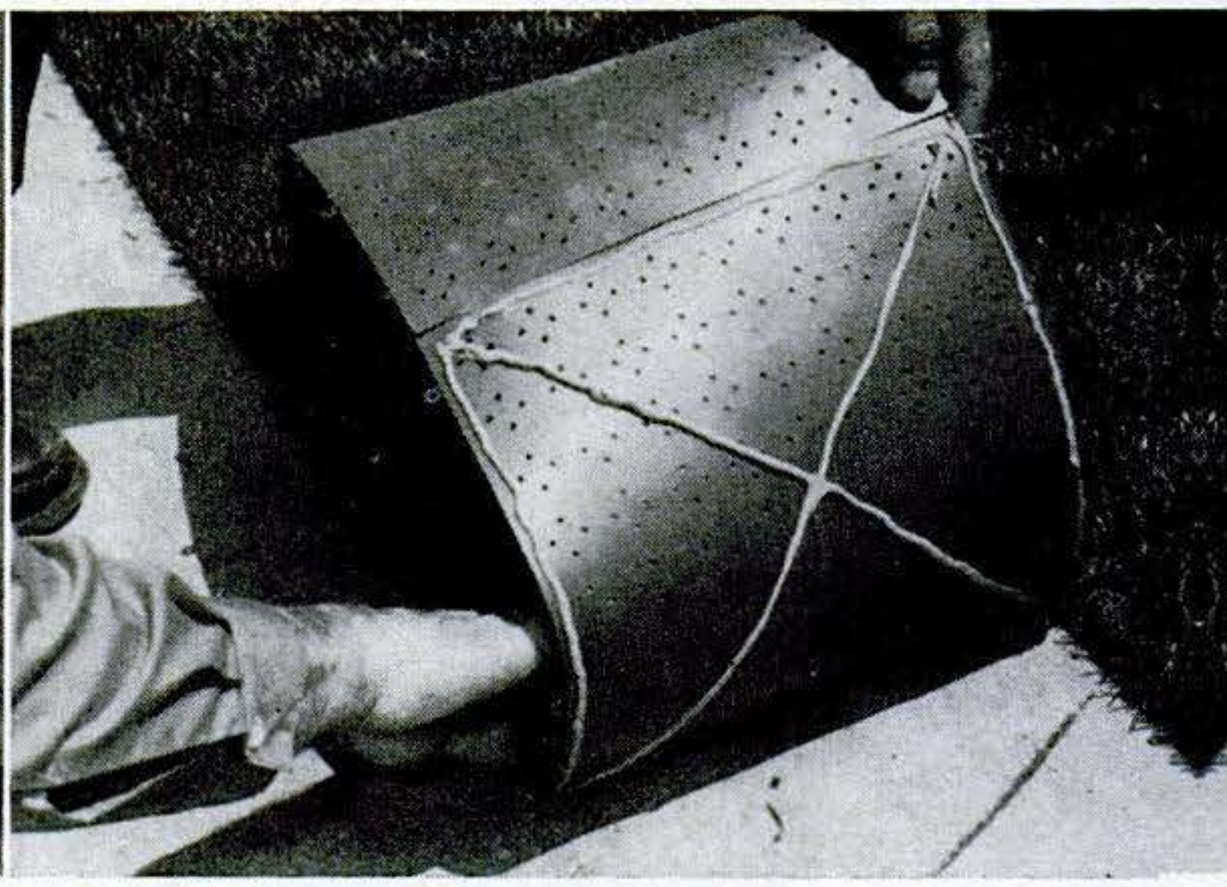


1 **Strips of roofing paper** were first cemented down over joints of the original roll roofing to cover up areas of oozing tar such as this one.



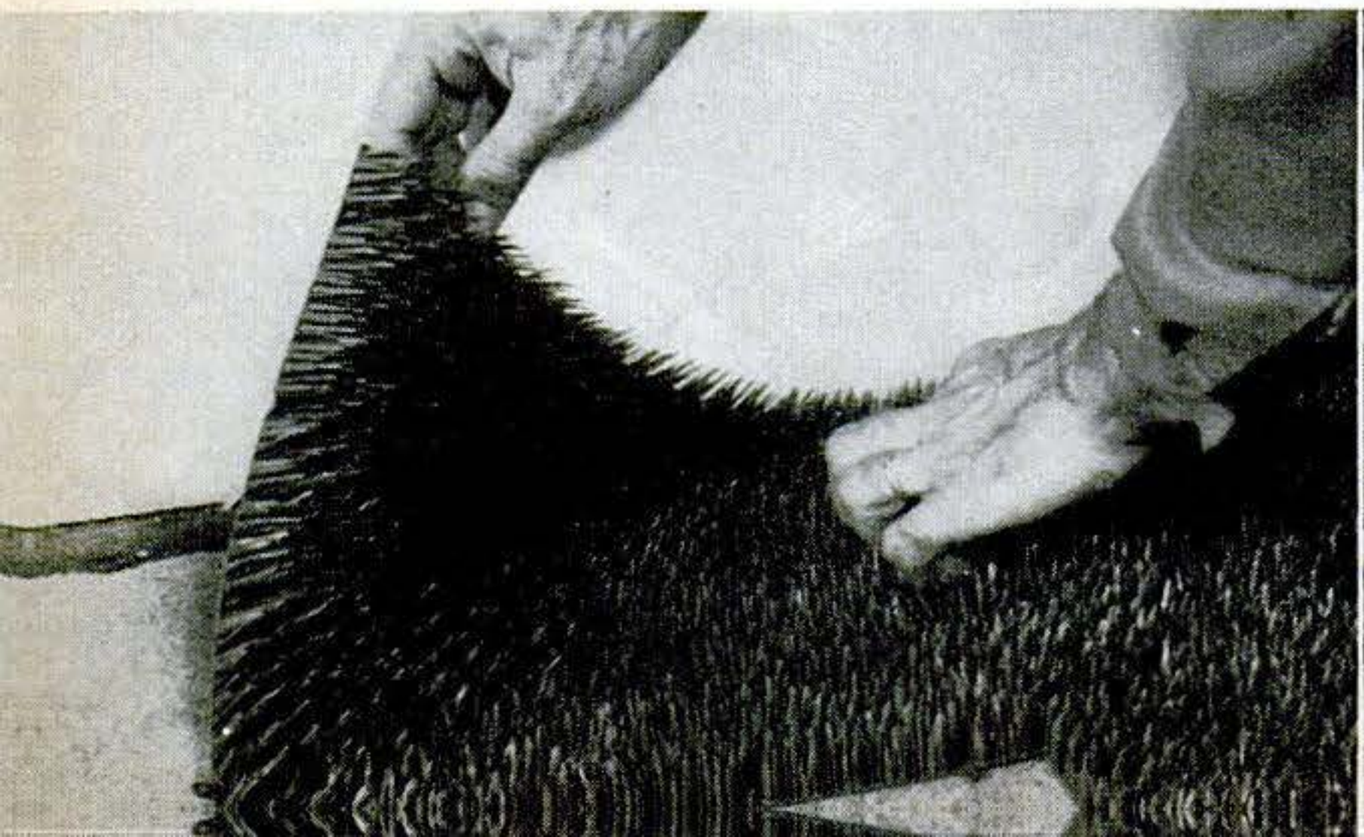
2 **Squares of make-believe grass** are locked together by pressing built-in tabs along edge of one square over mating pegs of another square.

4 **Thin bead** of waterproof wallboard adhesive was applied to each square of plastic grass as the strip of material was gradually unrolled.

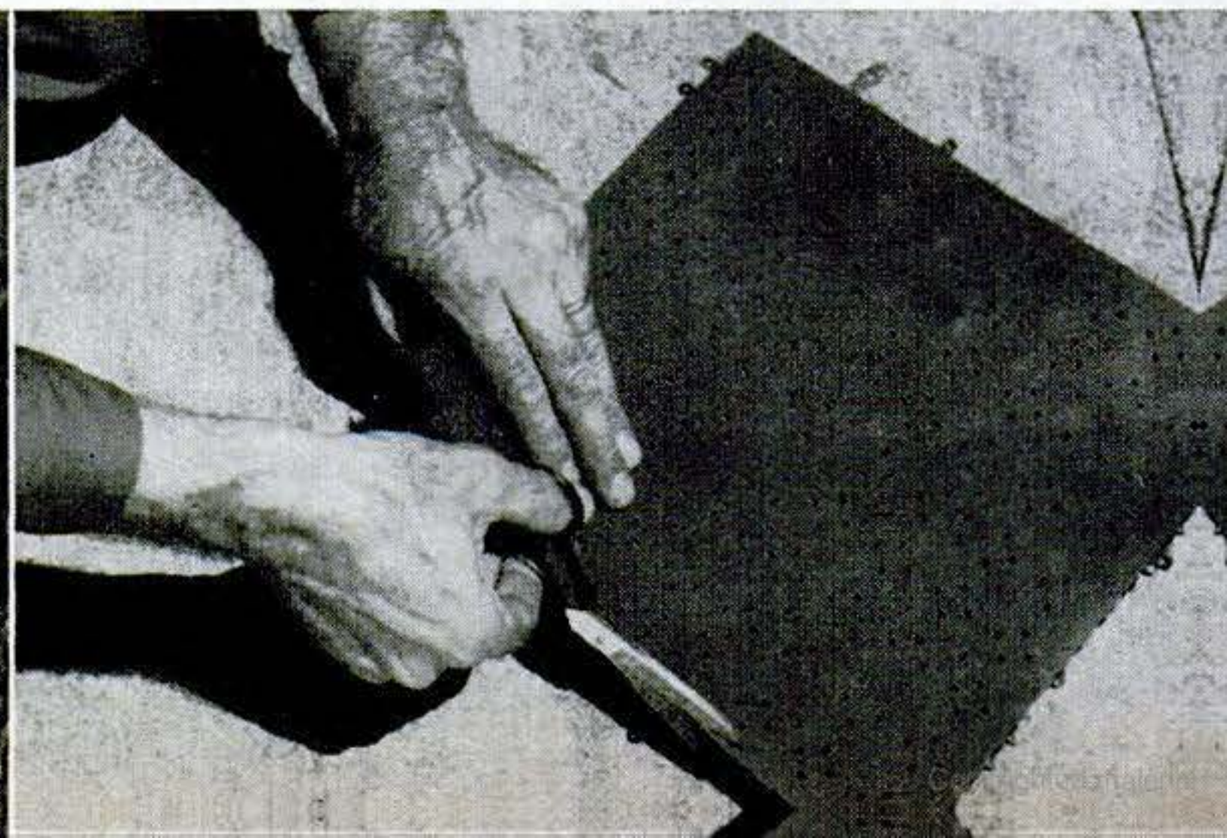


5 **A light, sweeping hand pressure** was used to bring the square into good contact with the old surface. Tabs between strips were interlocked.

6 **An adhesive-free square** of artificial grass was used to check for fit and straightness of wall before each row was cemented permanently.



7 **Tabs on sides** of squares adjoining a wall should be cut off with scissors. Author found it best to leave ½″ expansion space along walls.



3 **To make handling easier,** the 12″ squares were assembled into long strips, as above, and then rolled up. At the start of the job, author vacuumed all loose mineral grit from roll-roofing surface.

8 **Vacuum with deep-pile setting** was used by the author for cleanup after completing his new weatherproof make-believe lawn—one that never will need mowing, fertilizing, or watering.

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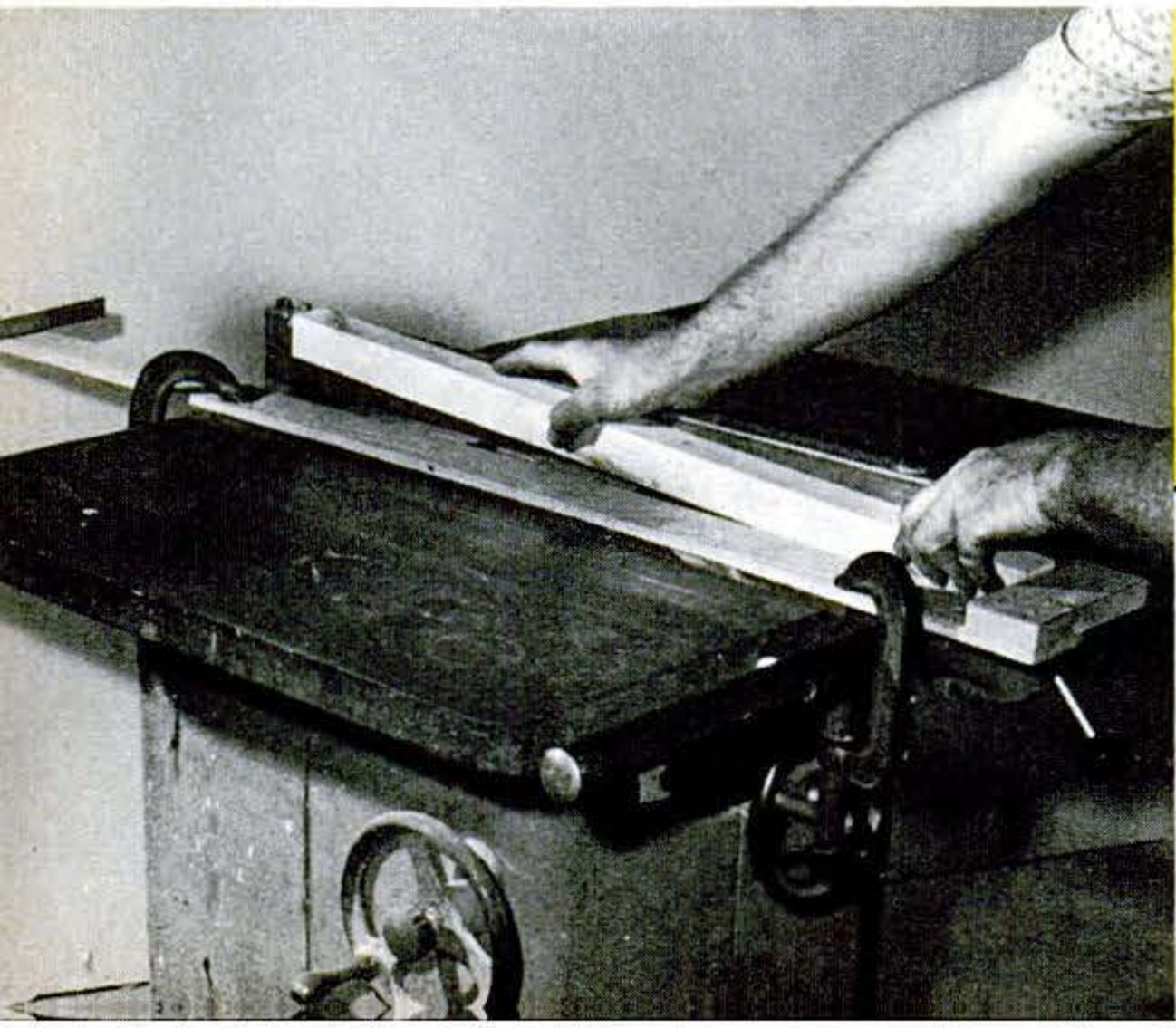
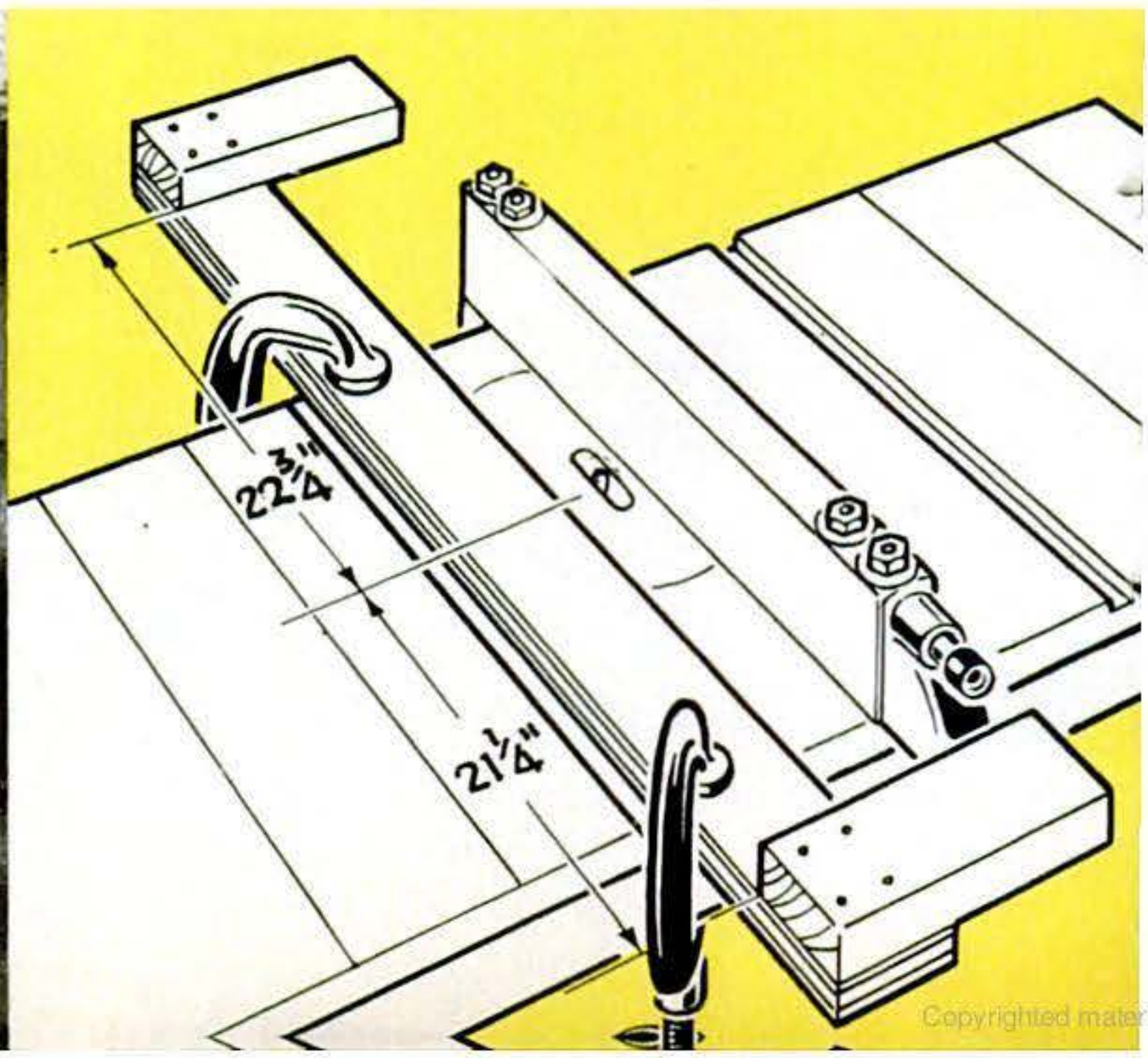
To flute the legs, make up a jig (sketch below) with the starting block set 21¼" back from the point where the molding head starts to cut. Place the stop block 22¾" beyond that point. Dimensions can vary, so test with scrap, and adjust if necessary. With the leg against starting block, and fence, lower it onto the turning cutter. Make the same pass on all three legs, move the fence for the next two.





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HOW TO BUILD
A Provincial-Style Desk

Using low-cost fir plywood you can create this handsome piece for less than $35

By CHESTER DAVIS

This desk was designed to meet two specific challenges. First, it had to blend in with the provincial furniture in my daughter's room; and second, I wanted to use fir plywood wherever possible, due to its low cost. By using one of the commercially marketed antiquing kits for finishing, both design and material requirements were met.

Pine was used for framing members and the legs were made from fir. The desk top is ¾″ ply, and is plastic laminated; all other plywood is ¼″.

To speed up the decorative molding work, all the pieces that required shaping were done at the same time. Craftsman mono-head cutters were used here, and the catalogue number for each one is shown on the blueprint. The numbers given are for a mono head; if you own a three-bit cutter, drop the last digit (3) from the number when ordering.

Start with the legs. Cut them to length and trim them to 1½″ square. The decorative molding work is required on the three front legs only. To assure uniformity of groove length, clamp start and stop blocks as shown on facing page.

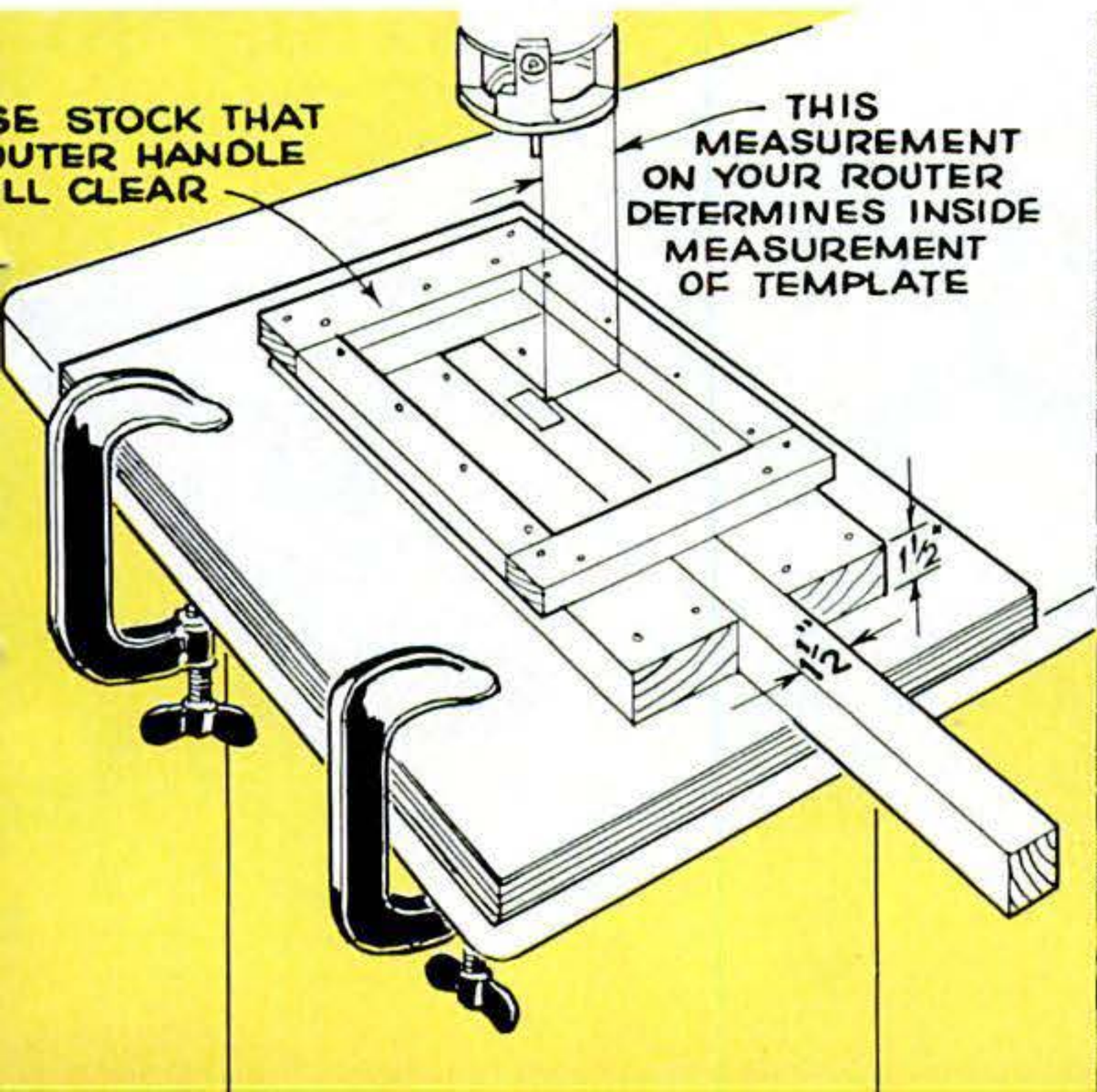
The two ⅛″ grooves at top and bottom were done with a router and template. When measuring the router shoe to determine the distance at which the template is set, measure from the outside of the cutter to shoe edge. When grooving, the router cutter should be on the inside of the mark on the leg. It's best to test both of these steps on scrap, before proceeding with the legs.

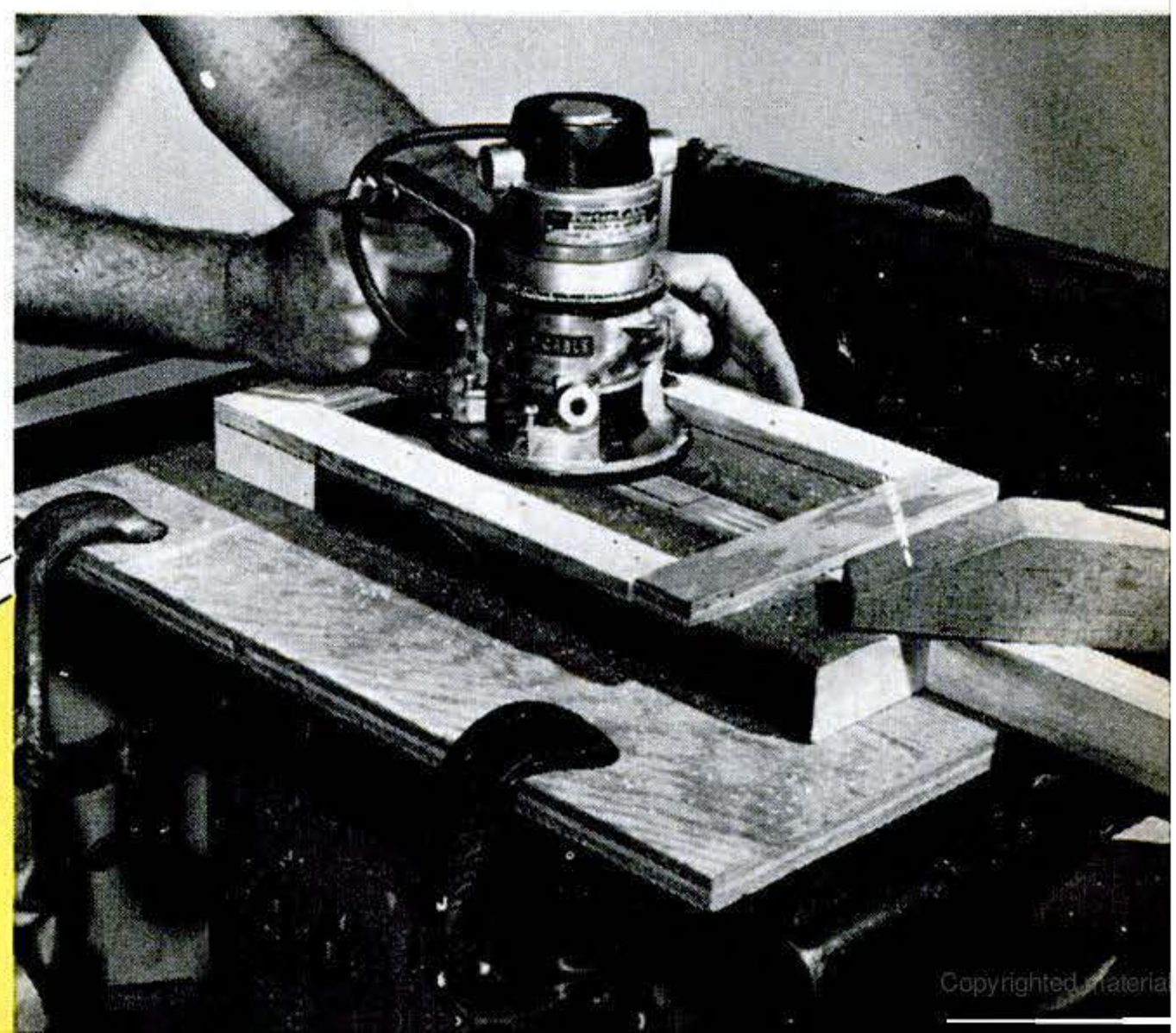
The ¾″ groove above the foot can be made using dado heads, or by making repeated passes through the combination blade. Taper the bottom 3″ on the bandsaw or by hand.

[Continued on page 198]

Turn the page for lie-flat blueprint

To make the ⅛″ grooves on the legs, use 1½″ stock and a clamp to hold the leg, ¼″ ply for the template. Each side of the template is set parallel to its corresponding groove line a distance equal to the measurement from router bit to shoe edge. Start the plunge in a corner and keep the shoe in constant contact with template. Do three rectangles; then, using same ply, remake templates to do squares.





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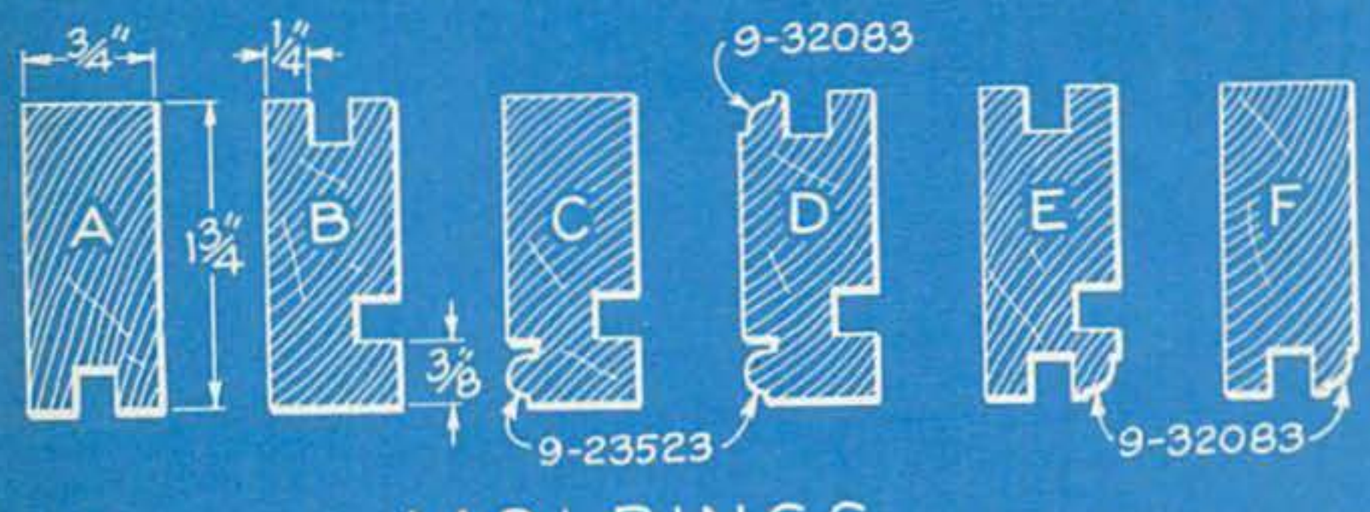
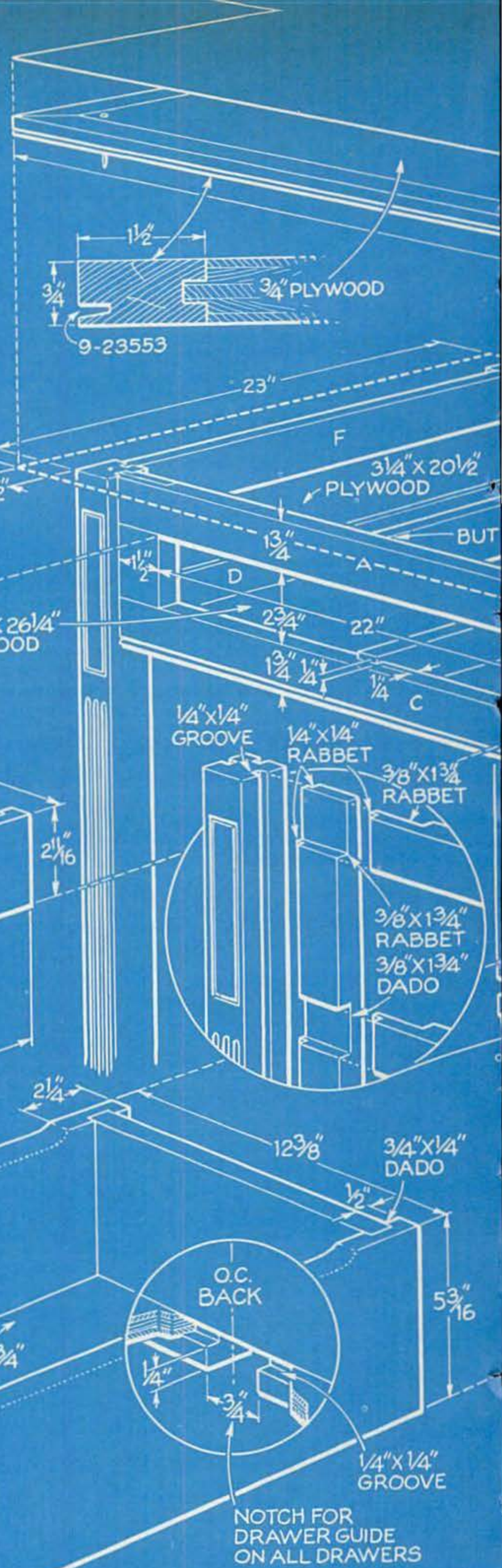
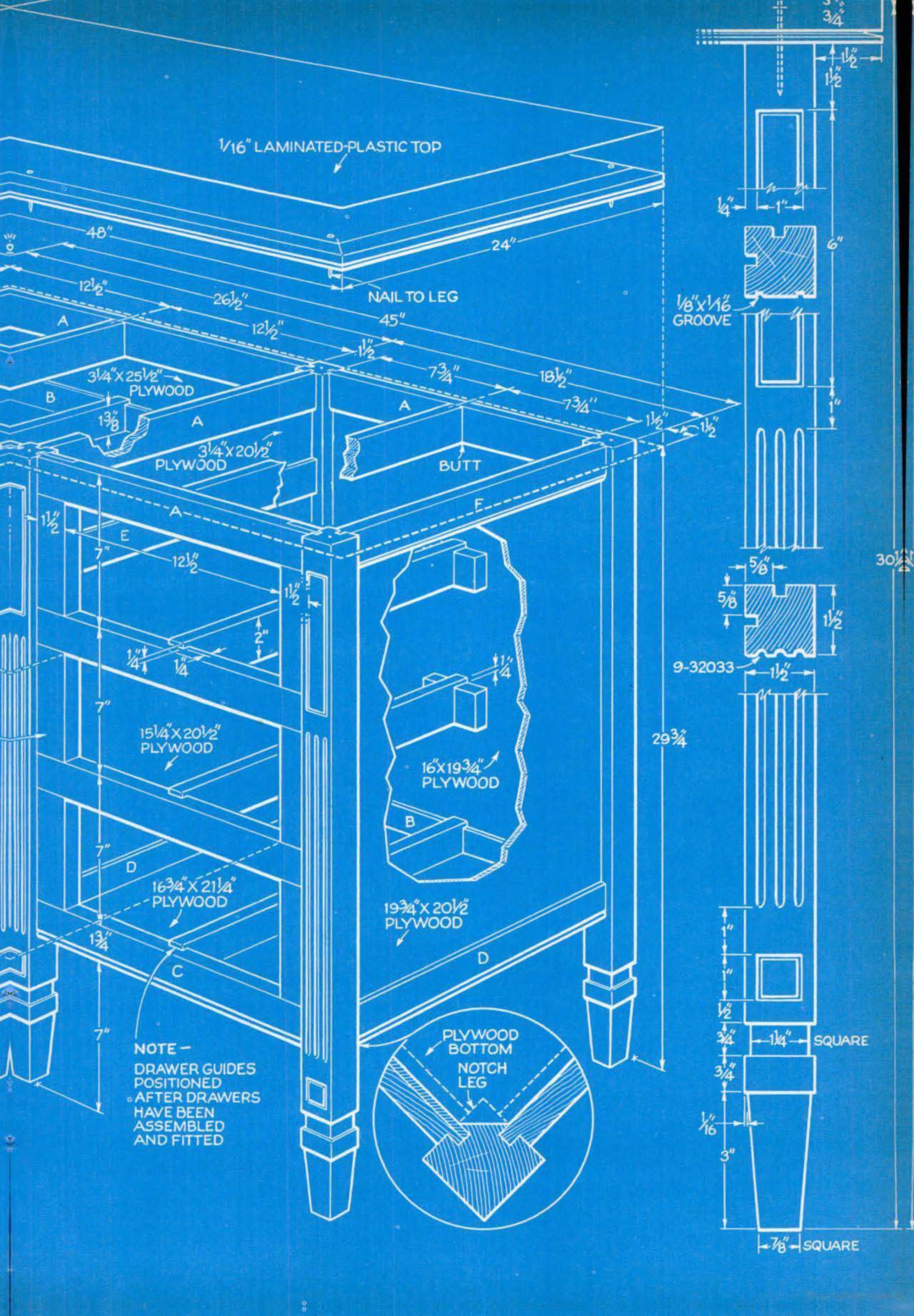


MOLDINGS

NOTE-
ALL MOLDINGS 1X2 PINE
ALL GROOVES 1/4"X1/4"
NUMBERS FOR MOLDINGS REFER TO "CRAFTSMAN" MONO MOLDING HEAD CUTTERS
ALL PLYWOOD 1/4"-EXCEPT TOP 3/4"

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NOTE –
DRAWER GUIDES POSITIONED AFTER DRAWERS HAVE BEEN ASSEMBLED AND FITTED
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PLYWOOD
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D
PLYWOOD BOTTOM
NOTCH LEG
3¼"
1½"
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1/8"X1/16"
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Gus Gives a Couple

"This solves the mystery," said Gus. "Have a good look."

When one of Gus's poker pals accused another of selling him a lemon, Gus had to play his cards right to restore peace

By MARTIN BUNN ILLUSTRATION BY RAY QUIGLEY

"I fold," muttered Pete Vancourt, throwing down his cards. "George is too lucky for me. I should have known."

"Meaning what, Pete?" demanded George Bell, pausing in the act of raking in the pot.

Vancourt's lantern jaw assumed a stubborn set. "Meaning you can take care of yourself, more ways than one."

Gus Wilson gathered up the cards. "At these stakes," he quipped, "George won't get rich, even if he is the big winner."

"Maybe Pete's soured on that car he

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# of Poker Players a Hand

bought from George," offered Sam White, the local used-car king, with heavy humor. "And if you fellows keep on selling cars to each other, I might just as well retire, too."

"What it is," put in Ed Hastings, "is that Pete's just jealous of the white Cadillac convertible George bought to replace —for his old age—the Olds he sold Pete."

Bell flushed, his plump red cheeks a bright contrast to his snowy hair.

"If you've got a beef about the car, Pete, come out with it," he said.

The Adam's apple in Vancourt's throat bobbed. "Well, I have. That slush-pot transmission's got no pep, and the engine's all smeared up as though sprayed with an oilcan. It was clean when you sold me the car, but the man at the Five Corners station where you buy gas told me it's always been greasy. He calls it the Oily Olds."

Bell nodded his white-thatched head.

"Sure. I've had the engine cleaned three times, last time a month ago. It always gets oily again, but it doesn't use any oil. Bet you haven't added any since you bought it."

"No," admitted Vancourt grudgingly. "But there must be something wrong and, one of these days, I'll be stuck with a big repair bill."

"Hey!" protested Gus, "Are we going to play poker, or chew on about cars?"

The cards fell and the game went on.

Gus showed no surprise when Pete Vancourt rolled into the Model Garage next day in a well-kept 1965 Oldsmobile. Pete's usually sardonic face was wearing a sheepish grin.

"You heard me blow off last night, Gus. Maybe I'm off base; maybe not. Either way, I want to know."

"George Bell isn't a fellow who'd unload a lemon on a friend," remarked Gus.

"I didn't think so, either. But he wanted that Caddy awfully bad, and he did clean up the engine before showing me the car. Something's sure spraying oil around. That can't be good, can it?"

"No," admitted Gus. "Gun the throttle a bit after I get around in back."

As the engine roared briefly, he watched the exhaust. It was normal.

"You notice any blue-gray smoke on the road, especially when coasting down hill or on deceleration?" asked Gus.

"Can't say I do," answered Vancourt.

Gus signaled him to cut the engine, and opened the hood. The valve covers, manifolds, and air cleaner all showed an oily film, especially at the back of the engine, but there was no indication of oil coming from the filler cap, nor any oil-washed areas to suggest leakage from valve covers, fuel pump, or other visible joints.

Gus wiped a finger on the film and sniffed it, then pulled the dipstick. The engine oil was at the Full mark, with no trace of water or smell of gasoline in it. He unscrewed and inspected a spark plug, then replaced it.

"I don't think this oiliness is from the engine. It isn't burning oil, and there's no water or gas dilution in the crankcase to make up an oil loss."

Vancourt grunted. Gus had him restart the engine and run it for a minute at a fast idle, the lever in Park. Then, the engine at normal idle, Gus pulled the transmission dipstick. It showed fluid near the Add mark. He smelled it, then stared at the dipstick.

"Well?" asked Vancourt impatiently.

Instead of answering, Gus walked across the shop to another Olds, in for a brake job. His assistant Stan looked up in surprise as Gus raised the hood.

Pulling the dipstick from the automatic transmission, Gus compared it with the one he held, and took it to Vancourt.

"This solves the mystery of your oily Olds," said Gus. "Have a good look."

"They're exactly alike, of course."

"Exactly. That's just the trouble, Pete.

Continued

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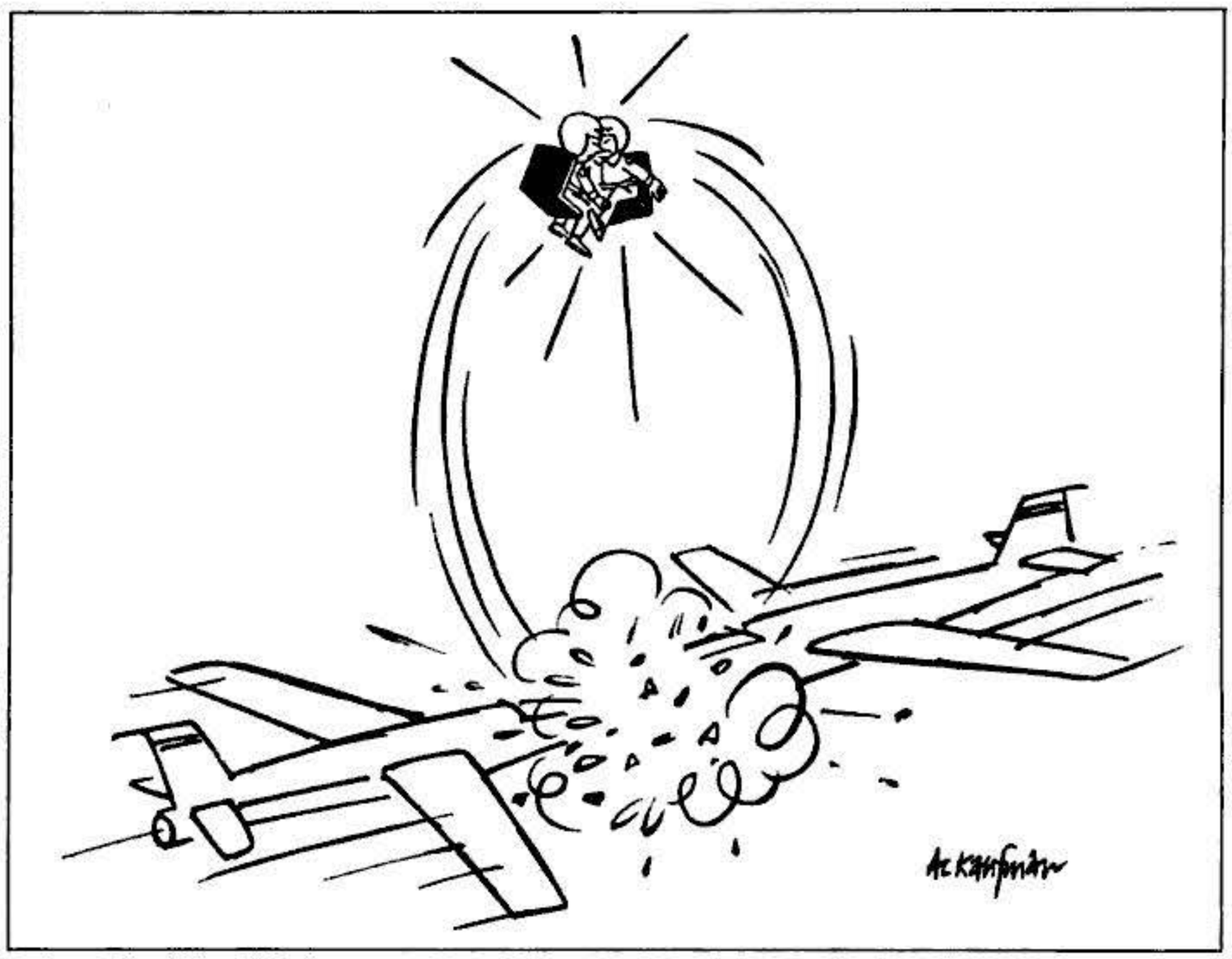
Your dipstick is the wrong one," said Gus.

"But they're both from Oldsmobiles."

"Yes, but this one is from a Jetaway transmission. Yours is from a Turbo HydraMatic. On the assembly line or later, somebody put a Jetaway dipstick in your car. The right one for your car is almost four inches longer.

"Using this wrong dipstick, when fluid is at the Full mark, it's really about three quarts over! So fluid blows out of the breather, all over the engine. It also foams inside, making the torque converter inefficient. Once the excess is drained, you should get better performance."



"So I was off base," said Vancourt. "Poor George. You fix it, Gus, while I think up a painless apology."

"Come get it tonight," said Gus.

A horn sounding outside, next morning, brought Gus to the fuel pumps. A '67 Cadillac convertible, spotlessly white, stood there.

"Fill it up, Gus," said Bell from behind the wheel. "And add oil."

Gus checked. It took a quart of oil.

"I sure do thank you for straightening out that thing between Pete and me," said Bell as he paid up.

"Glad to help," said Gus. "This the car the boys were kidding you about?"

"It's a childhood dream," confessed Bell. "When I worked for Oliver Kipp, in his drugstore years ago, he had a white Willys Knight. Ever since, I've wanted a fine, big, white car like that. When I was about to retire last fall, it seemed farther away than ever.

"Then Jim Wheeler, our comptroller, was transferred to the coast and didn't want to drive out. He put this car up for sale. He hadn't expected the transfer so soon, and the engine was being overhauled at Garretson's when I bought it. I sold Pete my Olds to help pay for it, and my wife and I planned a countrywide tour—another dream."

"When are you going?" asked Gus.

Bell's voice got husky. "Looks as if we can't afford it, not in this car. It guzzles oil. We made a few short trips, and every time I get gas it takes a quart of oil—or more. My brother-in-law, who thinks I'm wacky at my age to enjoy a car like this, is having a ball saying 'I told you so.'

"But worse, if we resell the car at a loss to get another, my pension won't stretch to cover any big tour, even the way we had it budgeted. Seems we'll have to settle for rocking chairs."

"Move over," ordered Gus. "We're going for a road test. Then we'll see."

Bell slid over. Behind the wheel, Gus headed for a highway. There he accelerated to 45, then suddenly let the throttle snap shut. Blue-gray smoke billowed from the exhaust. After speed had dropped to 15, Gus suddenly floored the gas. A big puff of smoke resulted.

"It's burning oil, all right," he reported, turning the big car around.

"Means a ring job, doesn't it?"

"Not necessarily. Oil can get into the combustion chambers through worn valve guides or, in some cars having oil passages in the block, past a damaged head gasket. You can get too much oil into the valve chambers—which will then get into the cylinders—because the return passages are clogged, or even because rocker shafts are in upside down.

"If there are external leaks, too, you lose oil two ways. Even one drop every

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Mercury / MerCruiser '68...

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'68 Mercury

The Payoff

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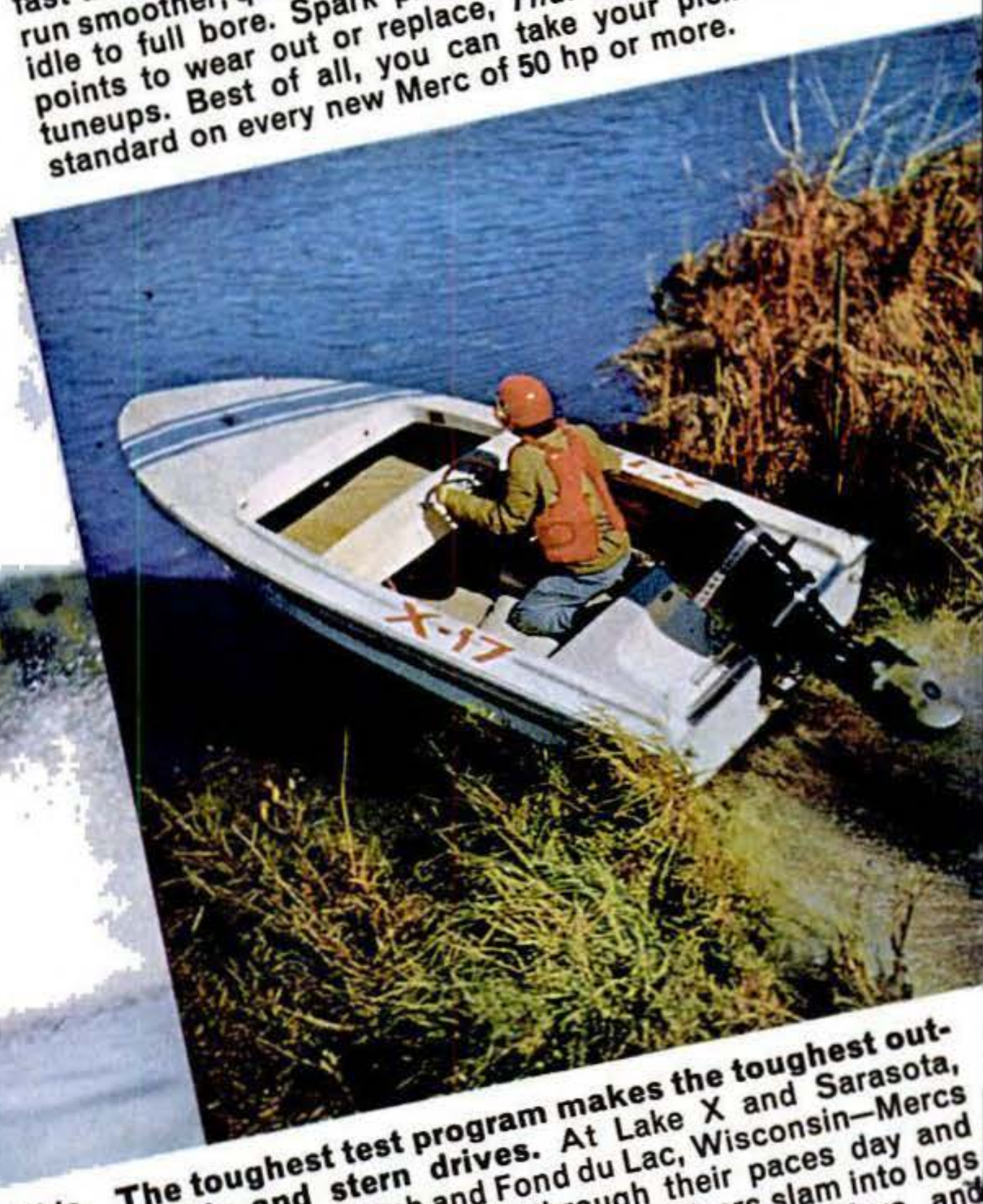

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Systems-designed. MerCruiser is not just an engine and a stern drive—it's a marine propulsion *System.* Steering, remote controls, propellers, instruments—every component is Kiekhaefer-engineered and Lake X-tested. They go together to make you go better. Look for MerCruiser Systems in your favorite boat at leading marine dealers.

and MerCruiser have won more races than all other s and stern drives combined. In the world's longest, ocean marathon, the "Bahamas 500," MerCruiser irst and Mercurys and MerCruisers took 7 of the first winding up 1, 2, 3, 7, 8, 9, 11. (The stock Mercs were gainst big racing inboards with 3 times the horse- 's the same story in all the important races—Miami- Sam Griffith Memorial, Orange Bowl Regatta, Lake Salton Sea, 6 Hours of Paris, England's 24-hour Inter- peedboat Race—with Mercs and MerCruisers winning ainst any and all competition. To win such races, you e than speed. You've got to be tough—really tough. And t to be proved before you get to the race—not during it. winning races or providing truly trouble-free family Mercury and MerCruiser have what it takes to do the job.

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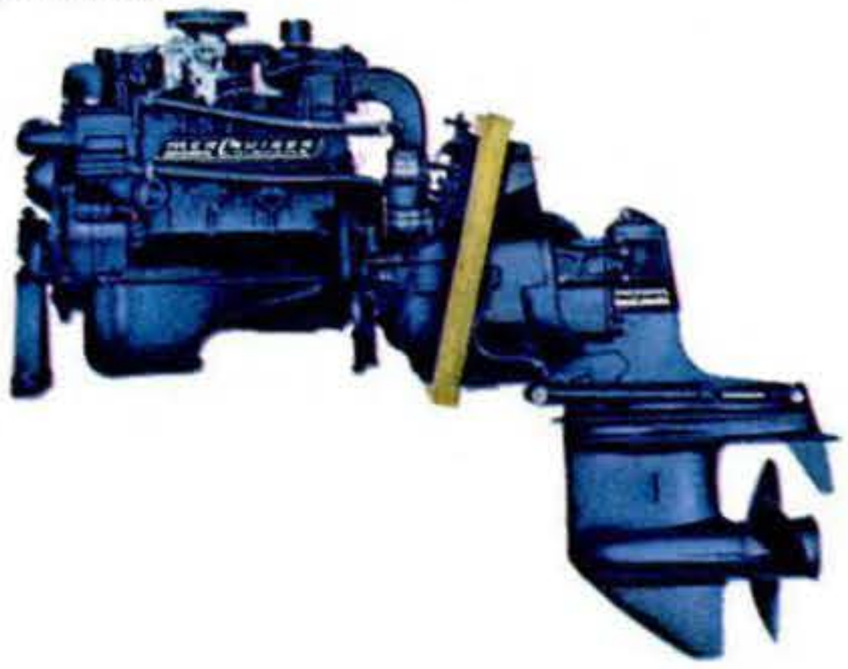
68 MerCruiser



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KIEKHAEFER MERCURY

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100 feet of car travel can mount up to a lot of oil. When bad rings or a clogged crankcase ventilator lets pressure build up in the crankcase, oil will come out at places you'd never suspect—places that would never leak otherwise."

Bell sighed. "If you think there's a prayer of curing this oil hog, Gus, let me out downtown and go to it."

"I thought," answered Gus with a grin, "that you'd never ask me."

By late afternoon, Gus was all but ready to admit himself stumped. A compression check showed the rings were sealing well. Though the car had considerable mileage on it, there were no external leaks. The valve guides had been fitted with seals. Oil-return passages in the valve chambers were clear, the PCV system was in good shape. All the spark plugs showed equal signs of oil fouling, which ruled out a local internal leak. That would have affected chiefly the nearest cylinder.

Gus called the Garretson shop.

"Tell me, Dave," he asked the shop foreman, "do you remember what you did when you worked on Jim Wheeler's white Caddy?"

"Valve grind, valve seals, new rings, new fuel pump, complete tune-up."

A faint bell rang in Gus's memory.

"Those rings—did your man pick the right oversize, check the gap, and install them chamfer up?" he asked.

"You think we're shoemakers?" asked Dave Skelly in an injured tone. "Sure he did, but I'll check with him."

There was a shout, then a brief discussion away from the telephone.

"Yep," reported Skelly in tones dripping with sarcasm. "He miked the bores, got the right gap, put the chamfers up."

"Sorry about that," said Gus. "I know you stand behind your work. This is a job you people are going to have to make good on."

Just about closing time, Bell walked into the Model Garage office. "Any luck with my car, Gus?"

"None of those troubles I told you about applied," returned Gus with a grin. "It's the rings, after all."

"I was afraid of that," Bell said.

"Don't be. It won't cost you anything. Garretson's goofed. But they're fair, and they're going to make good. They put the rings on the pistons upside down, chamfers up, same as they are in 1966 Caddy engines.

"The '67 engines should have the chamfers *down* on the compression rings. All rings are marked, with a dot or a little *o* near one end. This has to be up in the groove, toward the top of the piston. But the mechanic, after installing a lot of rings in '66 engines, by force of habit put in yours the same way. So, instead of scraping oil back down into the crankcase, the rings pumped it up into the combustion chambers."

Bell's face crinkled into a grin. "If it works out, maybe I'll have the last word over that smart-aleck brother-in-law. And we'll have our trip."

Gus made out a bill for his work and handed it to Bell.

"Say, it seems to me I owe you more than this," remarked Bell. "You not only settled Pete's hassle with me, but you're saving me a lot I'd spend on oil."

"That's okay," returned Gus. "I expect a bonus out of this pretty soon."

"What bonus? When?"

"A peaceful poker game," answered Gus, "come next Saturday night." PS

Perambulating posies

If you happen to be going through Bay City, Mich., and see a flower shop scooting along the street, it's for real. Mr. and Mrs. George Rupp take their posies to the customers. The shop is a converted camper body on a GMC truck chassis. It has a big display window on one side.

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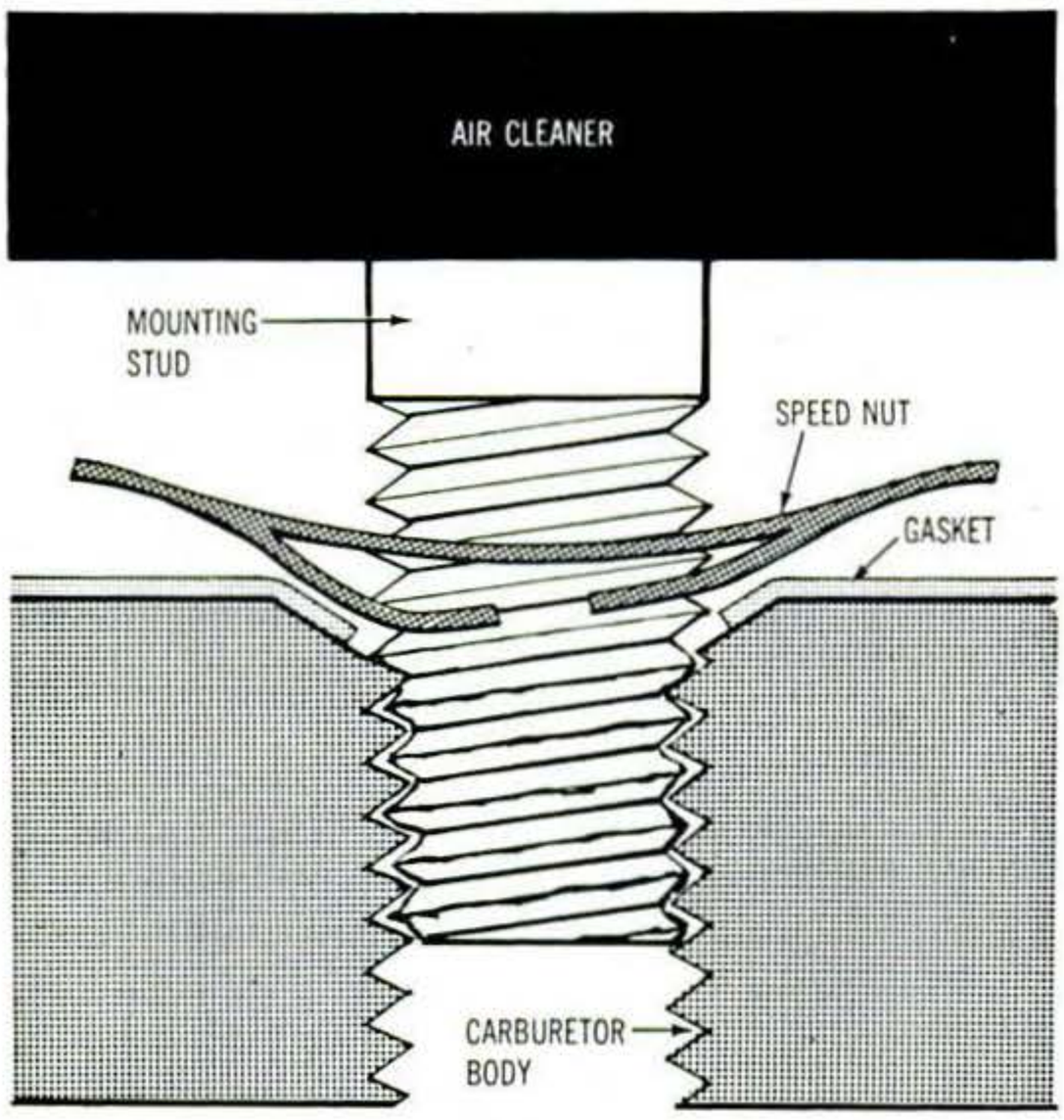
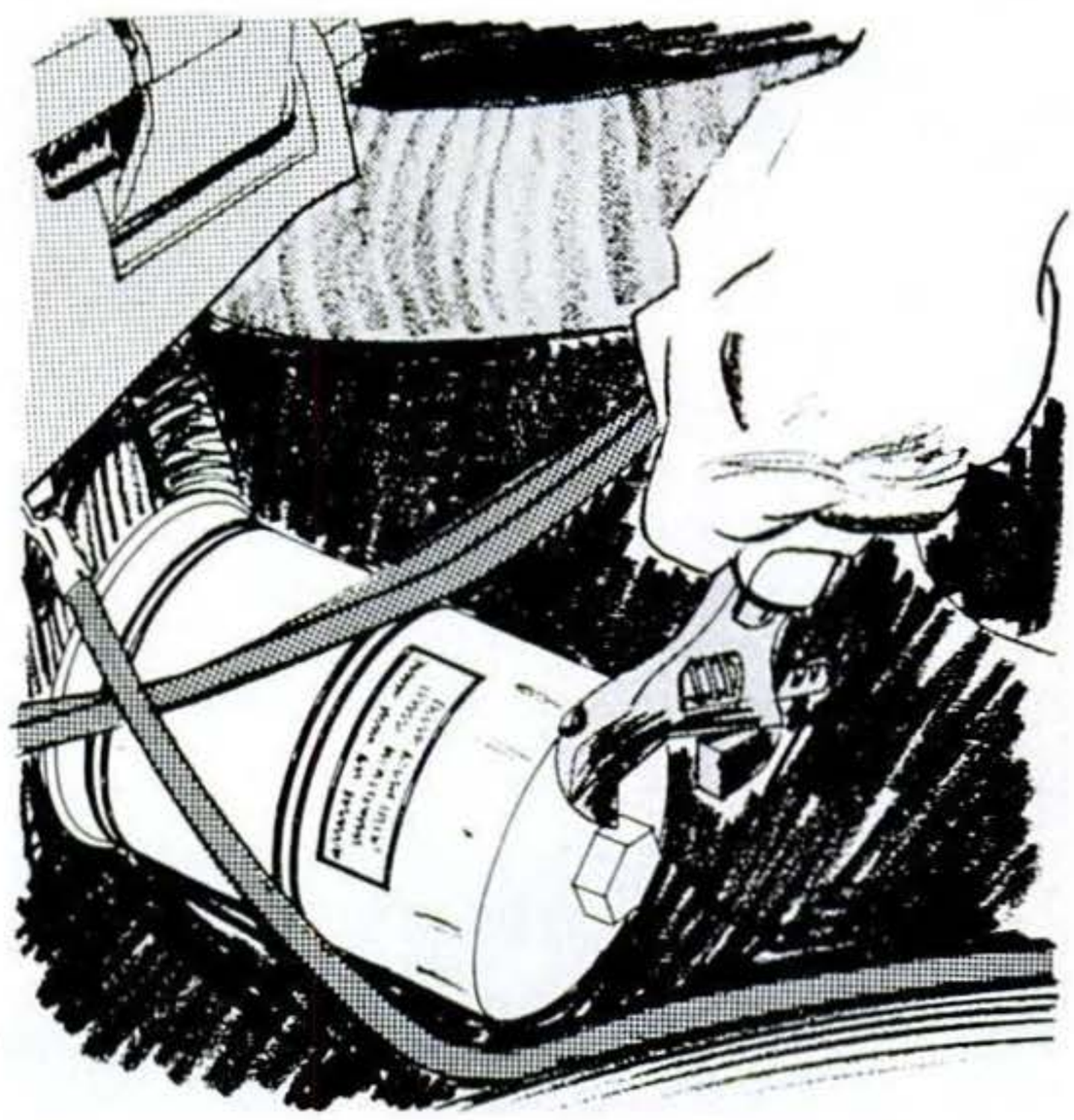
Hints from the Model Garage

DRAWINGS BY RAY QUIGLEY

To bleed an air-bound heater element it isn't necessary to drain the car radiator. You can do the job in a simpler way by pulling the top heater hose almost free of the heater connector tube and drilling a 1/16- or ⅛-inch-diameter hole (arrow) in the top of the tube near the end. Air will escape through this vent hole. When liquid starts flowing through the hole the heater element is no longer air-bound. Push the heater hose back to normal position, so the vent hole will be covered and sealed against the loss of coolant.



Stripped threads on the air-cleaner hold-down stud can be fixed by installing a 5/16-inch flat speed nut on the stud, as shown, after removing the carburetor top and countersinking the stud hole. The stud will then screw in tight and hold the air cleaner firmly.



When changing oil and oil filters on some engines, the oil pump may lose its prime and fail to pick up. Here is an easy remedy: Loosen the filter a little and start the engine. This will make the pump pick up the oil. Stop the engine and retighten the filter.

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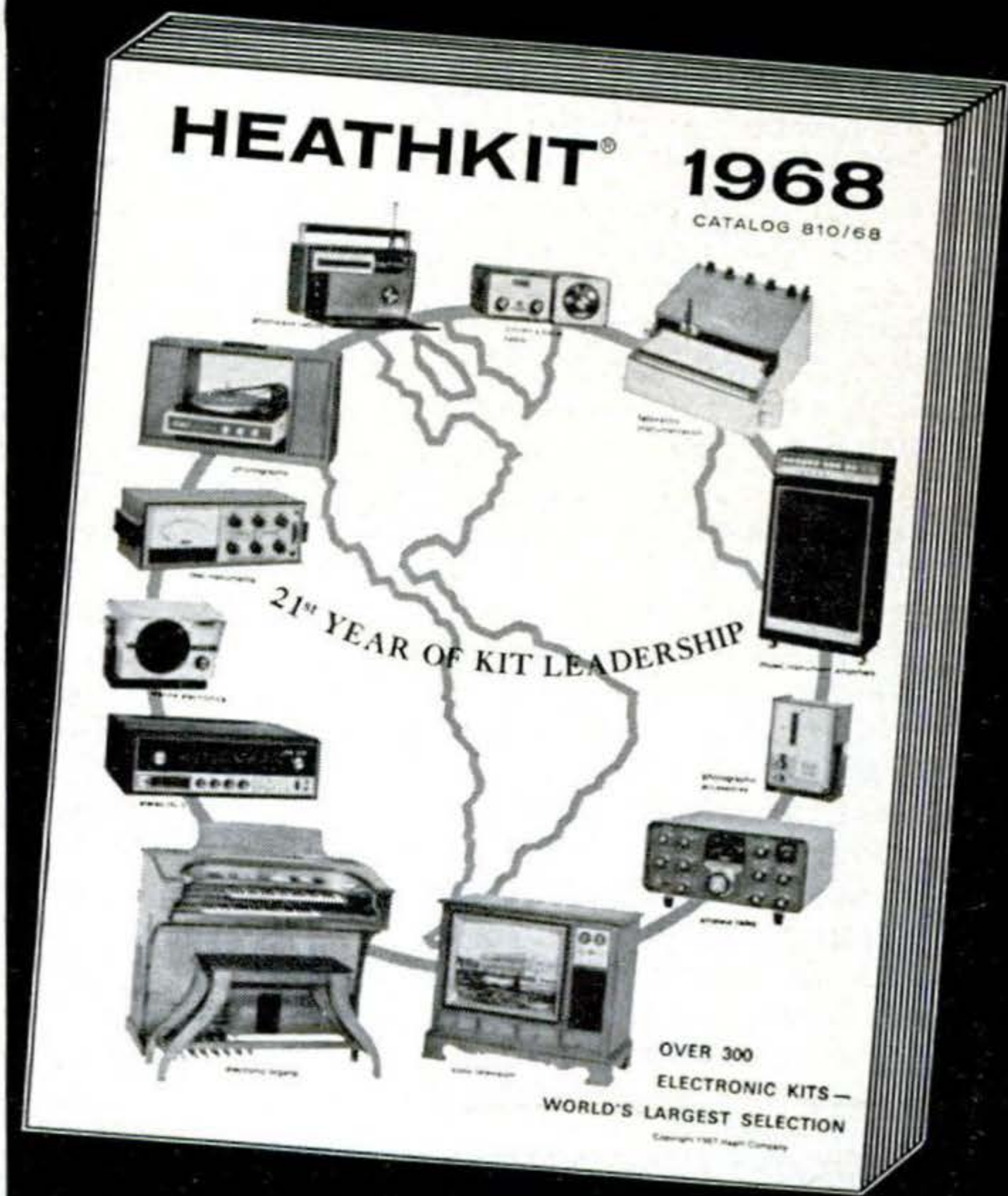

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How to Build a Provincial-Style Desk

[*Continued from page 183*]

The panels for the sides and back can be cut next. The molded rails, at top and bottom, are cut to length and attached to the panels. The rails on the back panels are not shaped, but are grooved to receive the ply panels.

Cut the stiles and rails for the front frames next. After grooving, assemble both of the frames temporarily and check the outside measurements. Each frame should be exactly the same as its opposite back panel.

Assembling the desk. If you are limited in the number of bar clamps you own, the best method for desk assembly is to preassemble subsections. Start by gluing each side panel to its mating legs. Check with a square before and after clamping. After the glue has dried you can go to work on the left side of the desk. Insert the back panel and front frame into the left side. Slide the bottom into the grooves and attach the center section. Next attach the front frame and back for the right side. Install the ply bottom and attach the final side.

Making the drawers. Build the four drawers as shown. Adjust the dimensions if necessary to insure that they slide freely in the desk. Each drawer should be a minimum of 1/8" less in width, and 1/16" less in height, than its corresponding opening. The drawer guide is simply a notch cut in the drawer back. Locate the cleat position by working from the front with a framing square. Use a couple of brads and glue to attach the cleats. Cut the drawer guides to length and install them starting with the lowest drawer and working up. Place the guide in its' approximate location and slide the drawer in. After positioning the drawer, slide it out carefully, and mark the guide location.

The top can now be assembled and positioned on the desk. Check the overhang to be sure it is set square; glue, and put an 8d nail into each leg.

Laminating the desk top. Follow the manufacturer's instructions to apply the contact cement. When the glue has dried, carefully drop the plastic onto the desk top. To assure a good bond, slide a block of wood over the entire surface, tapping it with a hammer as you go. Trim any overhang with a file.

The pencil tray is simply a piece of crown molding glued to the bottom of the drawer. Make sure there is enough space for the drawer pull screws before inserting the tray. A strip of 1/4" lattice can be attached to the tray edge to keep pencils from rolling out.

Sand the desk and apply a coat of sanding sealer before antiquing. The color choice for the desk shown was antique white with gold striping. Attach the hardware, and you can catch up on those letters you've been promising to write for such a long time. PS

The gold striping on antique white gives added period accent to the desk in photo above. It goes on just before the final clear finish.

MATERIALS LIST

- 1 plywood panel 3/4"x2'x4'
- 1 plywood panel 1/4"x4'x8'
- 1 pc. 1/16"x2'x4', plastic laminate
- 3 pcs. 1"x2"x6' pine
- 5 pcs. 1"x2"x8' pine
- 1 pc. 2"x2"x10' pine or fir
- 1 pc. 2"x2"x5' pine or fir
- 2 pcs. 1"x3"x8' pine
- 1 pc. 1"x4"x2' pine
- 1 pc. 1"x6"x10' pine
- 1 pc. 1"x6"x8' pine
- 1 pc. 2 5/8"x2' crown molding

Misc: 4 drawer pulls, 1 qt. contact cement, antiquing kit, assorted nails, flathead screws, glue

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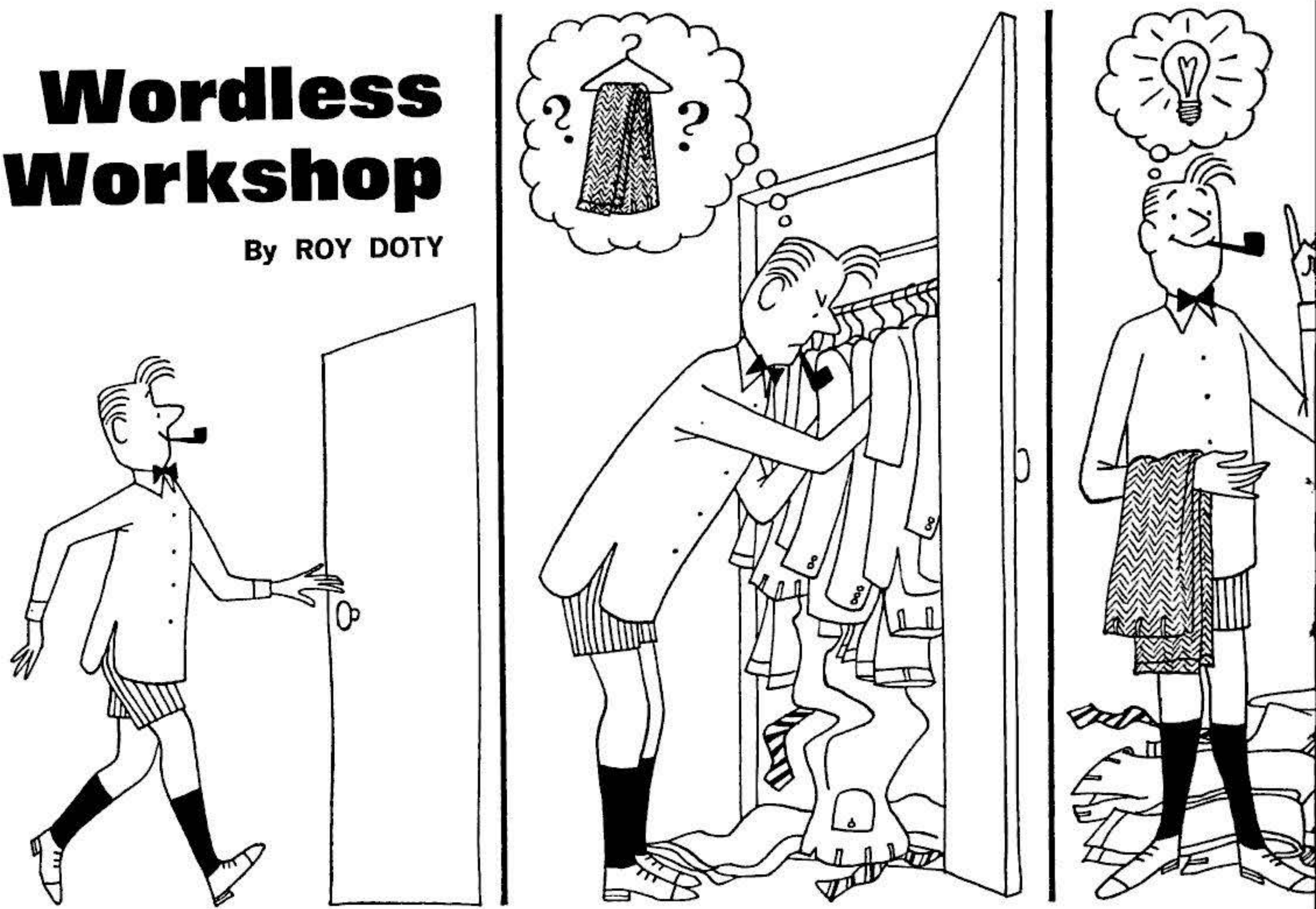
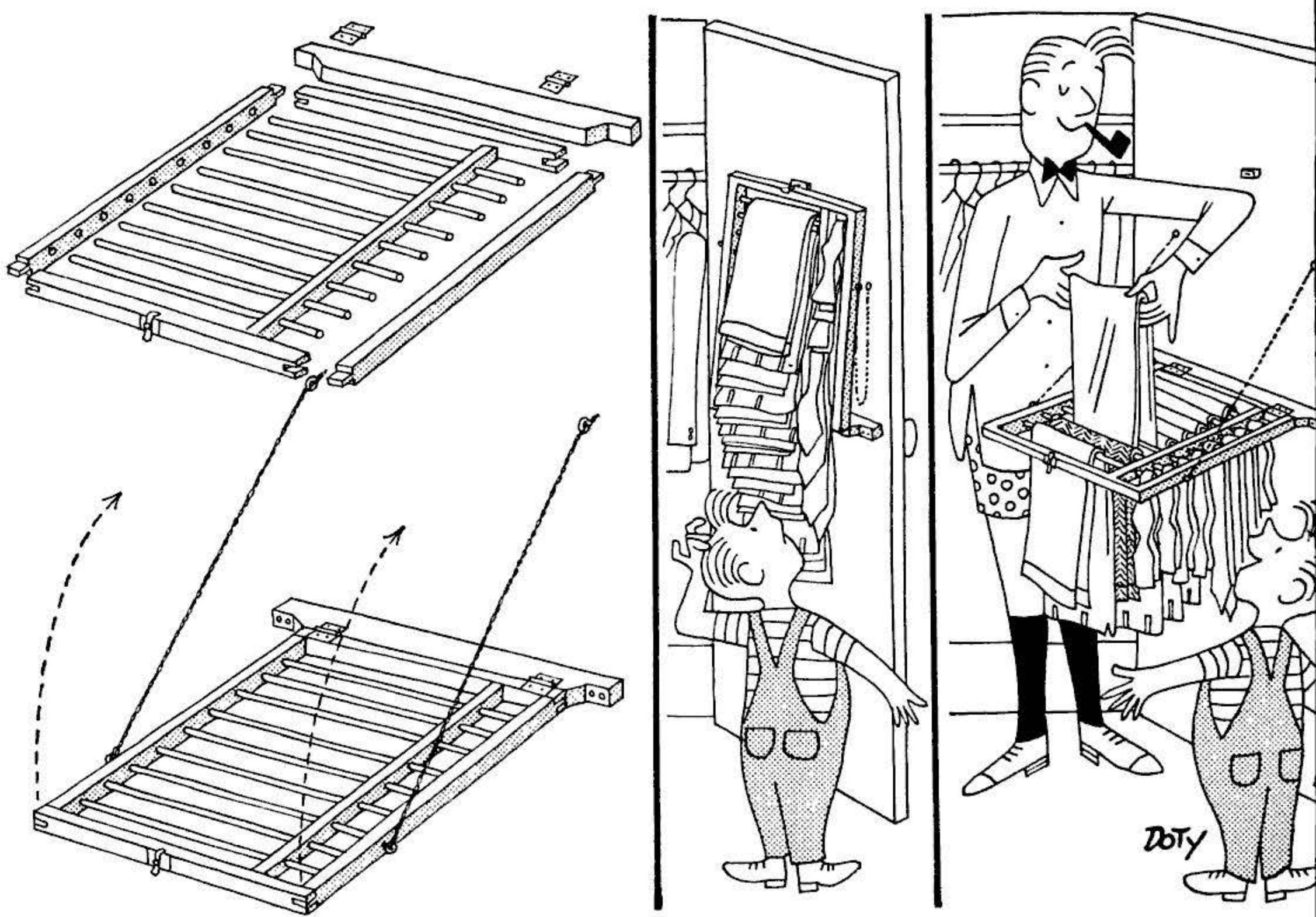
By ROY DOTY





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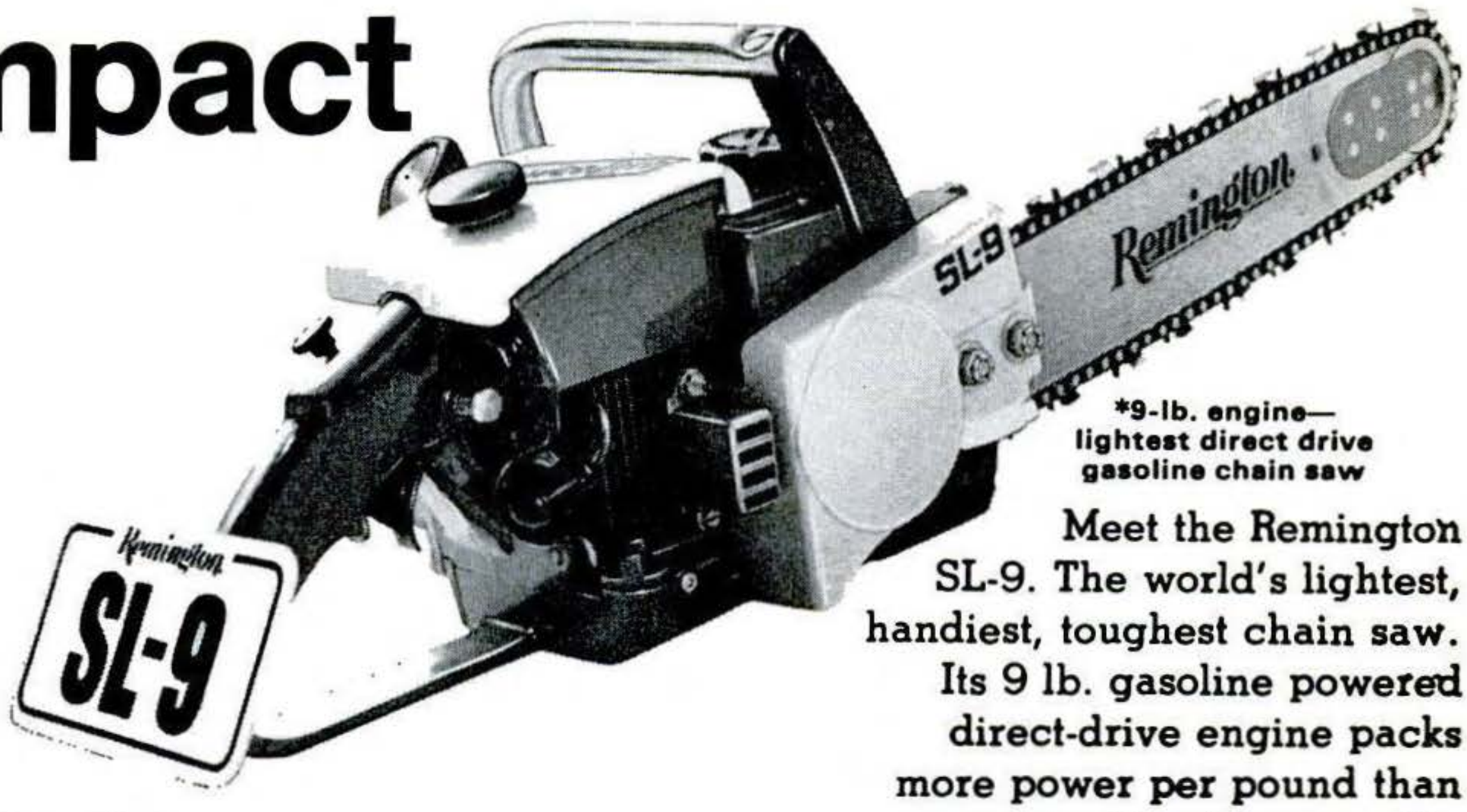
Remington's got a 9 pound* compact



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[Continued from page 86]

veloped about 1,500,000 kw., or 2,000,000 hp.—more than the entire electrical output of Hoover Dam.

The Phoebus 1 reactor, with a core of only 35-inch diameter, gives a thrust of about 80,000 pounds. NERVA's 200,000-to-250,000-pound thrust will require a core 50 to 55 inches in diameter. However, the core's length will remain the same, and so the length of the hydrogen passages is unaltered by the scale-up to NERVA performance.

The Phoebus 1 runs, especially the last one, prove that a NERVA flight reactor can be built successfully. This will be further demonstrated by a 55-inch Phoebus 2 reactor to be tested later this year. Phoebus 2, like NERVA, is designed for a power of about five million thermal kilowatts or 6,700,000 hp. It has already had a successful "cold flow" trial, a preliminary one before operating with a hot reactor, at the Nevada proving ground.

The projected NERVA engine, under contract for development by Aerojet and Westinghouse, will be a completely integrated, flyable nuclear-engine system based on the Phoebus reactor. When ready, it will be incorporated in a Nuclear Propulsion Module (illustrated on a preceding page) that can be used for a variety of applications. Here are some outstanding examples:

Direct-to-moon flight. The module can serve as a third stage of Saturn V, whose main diameter of 33 feet it matches. It nearly doubles the Saturn V's payload for some applications. This will permit manned flights to the moon direct—without a separate LM and rendezvous in lunar orbit.

Earth-to-moon shuttle. The same module, with a propellant tank of different length, provides a spacecraft to shuttle between earth and moon.

Moonbound passengers, arriving from earth in an orbital transport, board the shuttle in earth orbit.

The shuttle, under the power of its NERVA engine, adds to its orbital speed the 11,000 feet per second (7,500 m.p.h.) necessary to coast to the moon. Three days later the nuclear engine is turned on again for retrofire to slow the shuttle and allow it to be captured in an orbit around the moon.

An LM-type vehicle takes the moonbound passengers down to the lunar surface, after having disgorged a crew desiring to return to earth.

A third short boost by the nuclear engine drives the shuttle out of the moon's orbit again. A fourth and final blast, three days later, de-boosts it into its original earth orbit. Its hydrogen tank, now nearly empty, is refilled by an earth-to-orbit tanker for the next round trip.

Note that the propellant supply does not have to be replenished near the moon—the hydrogen need not be transported so far. Nor does NERVA's reactor need refueling with uranium 235. The shuttle could make this round trip many times with the same reactor core, and herein lies its economy.

Mars flyby. We can use the propulsion module, too, for a manned Mars flyby mission—where heavy crew supplies for a travel time of two years, and rather high velocity requirements, exceed the capabilities of an all-chemical Saturn V.

Mars landing. Finally, a cluster of propulsion modules will enable man to land on Mars.

Assembled in earth orbit, the spaceship will be started toward Mars by three modules firing simultaneously. A single "Mars-arrival" module will de-boost it into Martian orbit. Astronauts will descend to Mars' surface, and return to the orbiting ship, with a chemically powered craft based on LM and Voyager technology. Another NERVA-powered "Mars-departure" module drives the ship back to earth, where the crew will descend in a reentry capsule.

Retardation upon arrival at the earth will be with the help of aerodynamic drag only. This will be a problem in itself, for the reentry capsule will not reenter at a "sluggish" 36,000 feet per second (24,500 m.p.h.) like an Apollo Command Module returning from the moon. The reentry speed may be as high as 60,000 feet per second, or more than 40,000 m.p.h.! But heat-shield experts are confident that they will be prepared to meet that challenge, whenever NERVA is ready to do its part. PS

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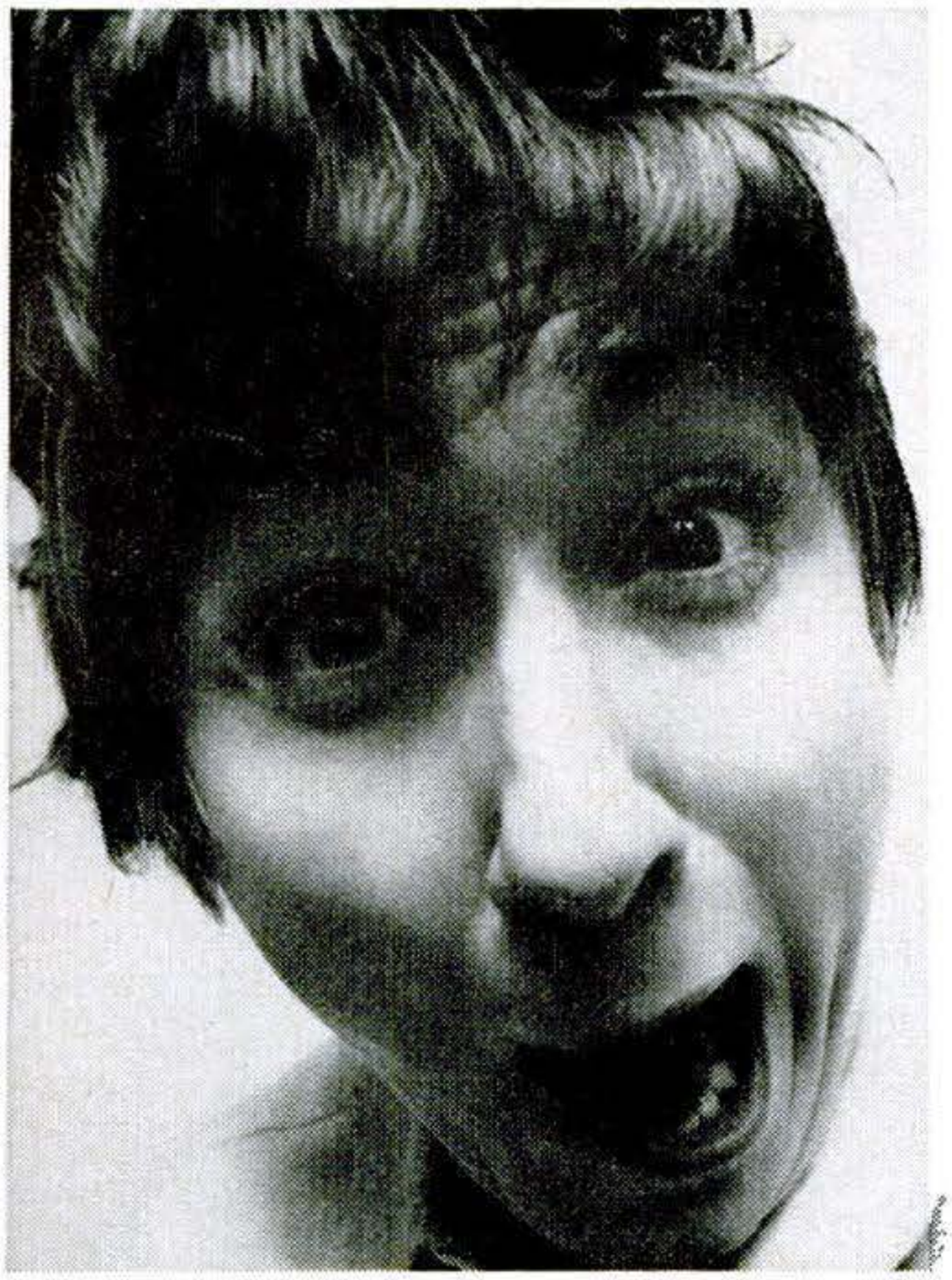
"Are you going to paint it this weekend, or aren't you?"



There she goes again.

And what are you going to do this time? Hide in the cellar? Again?

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You can take care of all that overdue painting. And still have time to catch the ball game.

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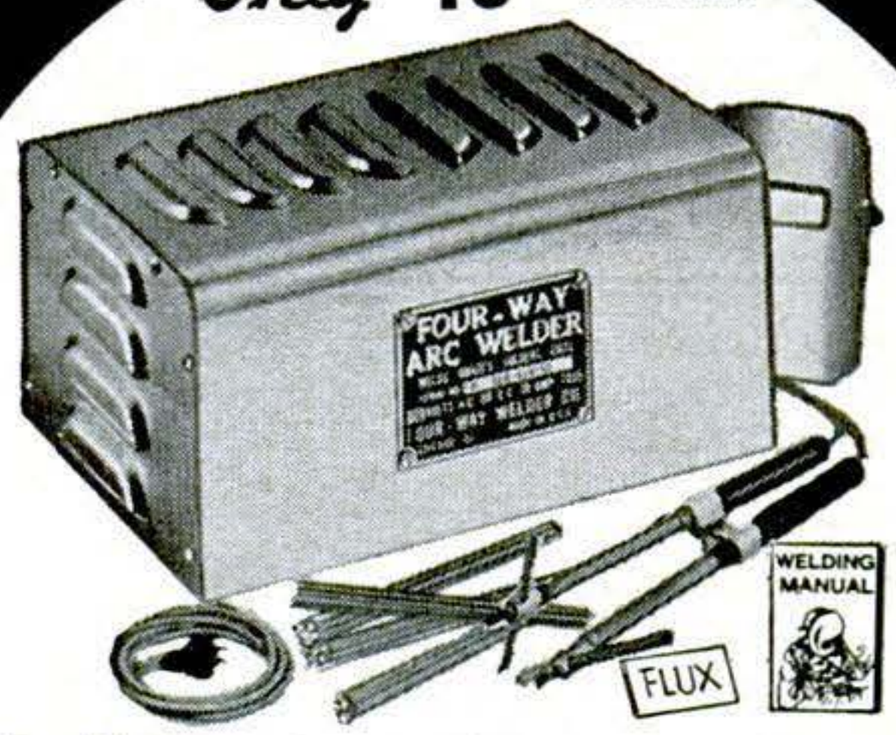

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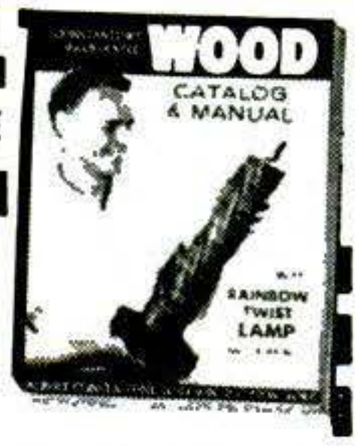

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They Dropped Me in the Ocean . . .

[*Continued from page 93*]

At 500 feet or so up, I reached down and yanked a handle. Down fell the survival kit and the nine-pound raft. Still tied to me, the raft inflated jerkily. The wind caught it, flapped it wildly behind me, and I began swinging like a marionette. Then I reached under my left armpit and yanked my preserver release. *Whap!*—my arm shot up as the tube inflated.

Then I relaxed somewhat and looked below me, to the little toy boat—*holy mackerel*—50 stories down.

I signaled that I was ready for release (and hadn't fainted) by spreading my arms. The towboat slowed, taking tension off the line, and I reached up and released the tow hooks.

Shortly, with a mighty *schlumph* and a snootful of water, I entered the sea, released the parachute, and surfaced. Bobbing 10 feet from me, just as the manual says, was my raft. The wind was pushing it away, so I swam towards it, my clothes and preserver dragging. The raft sailed off. I swam harder. The wind skipped it faster. Then I stopped. My line! I had forgotten again. I found it and pulled the raft to me.

You get on the raft's little end, and make sure you're upwind. I neglected that last. Of course, the wind got under the boat, flipping it over onto my upturned face. I tried again, upwind, and slithered face first into the watery interior. By then, the towboat had left.

Alone on the sea. Slowly I unraveled myself from the straps and lines, threw my sea anchor overboard, and opened my survival kit. The flare I tied to my harness, handy for emergencies. That done, I stuck the package of patches (packed in the raft) into my pocket, adjusted the rubber-sheet spray shield, and bailed out most of the water with my helmet—a cute trick, I found, when your body forms the lowest spot.

Next I cracked open a desalter kit, filled it with water, dropped in an aluminum silicate cake, squeezed it awhile, plopped it overboard. In an hour the chemical would combine with and settle out nearly all the salt.

After trying out the signal mirror for awhile (nobody answered), I tried to

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They Dropped Me in the Ocean . . . find a comfortable position. Though my bottom remained frigid from the proximity of the sea, the sun was broiling my top surfaces. Later I was to find that reflected sunlight had burned my nostrils, earlobes, and upper eyelids.

I had been drifting for only an hour. But already I was obsessed with thirst. I reviewed some of my water notes:

- Never drink salt water, even diluted. You *can* live six days on seawater before dying of dehydration and poisoning, but you can last 10 days with no water.
- At 75-90 degrees, a man will dehydrate at the rate of two percent a day with no water. At 10-percent dehydration, he can no longer think rationally or perform tasks. At 20-percent, he's dead.
- Don't drink anything for the first day. That water would go through you.
- To stay alive you must drink at least a pint a day. Survivors have been picked up dead, water—too tightly rationed—still aboard. If you have extra, drink it; your body is a good storage tank.
- If you haven't enough water, don't eat. Digestion needs water. And you can go for weeks without a morsel.
- Stop water wastage by wetting clothes with seawater. This can cut perspiration by 70 percent.

Man, was I thirsty!

I had brought along a hook and line, however, and I was going to fish whether or not I had water. So I baited my hook with a delicious strip of tinfoil, and waited. And waited.

Tiny fish, I knew, could be eaten whole or used as bait. Most fish are edible, but one should beware of highly colored fish, those with spines, those that puff, those that are sick, and those that don't look like fish, such as sea snakes. To make doubly sure you won't be poisoned, eat only slices just down from the backbone, and wash them for 10 minutes three times.

Catching a raft. I felt a nibble, so with visions of raw fish making me salivate all over my arm, I yanked. And then I heard a sound that surpasses even the squeal of brakes in its ability to horrify: the hiss of air escaping from a liferaft. I had snagged the side.

I dove for the survival kit. Where is it? I'm sitting on it. Rip it open. No patches. *No patches!* Oh, yes, I had put them in

Continued

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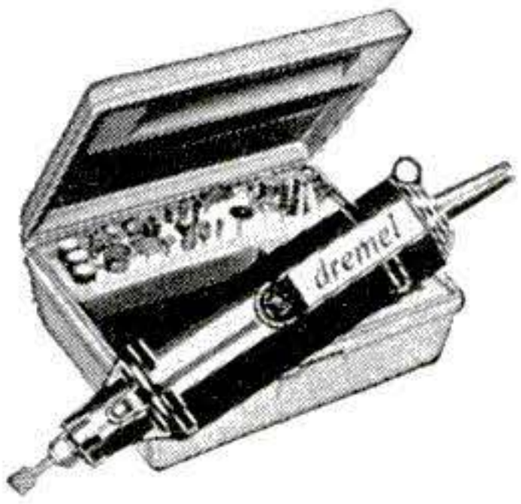

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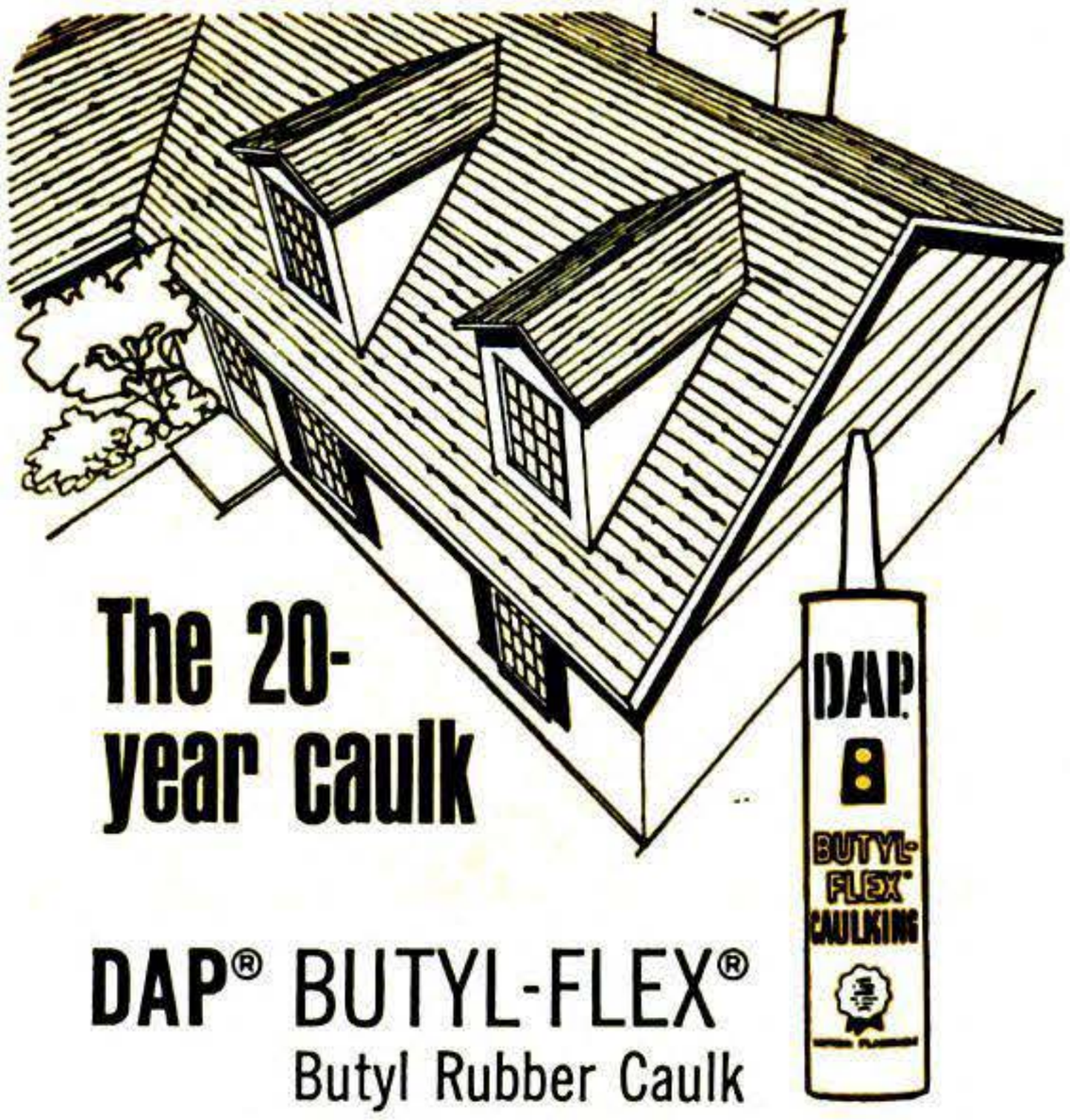

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They Dropped Me in the Ocean . . .

my pocket. I opened my knife, converted the hole to a slit, worked half the patch through, tightened the other half down (thank God this one works), blew the raft up again, and all was again right with the world. Whew. . . .

My next catch was seaweed. Some kinds are edible. This one wasn't. By waving it over my lap, however, I shook out a couple of tiny shrimplike creatures that would make good bait.

The day crawled by. The constant bobbing, the frying sun, the bilge water icing my bottom—it was finally getting to me. After six hours I was nauseated.

I tried to dry the boat, first by bailing again, then by mopping up with the survival-kit sponge. To get that last little bit from under me, I raised myself on my heels, leaned on the edge, and carefully reached down under me.

The boat flipped over. In an instant I was no longer bored. Back into the boat I crawled, wallowed over again, and again bailed. My knife was gone, my fishing stuff, signal mirror, pen.

As I bailed, I noticed the water under me getting increasingly muddy, then gray, then black. The package of shark repellent—a combination of disagreeable smell (to sharks) and black dye—had broken, and I was sitting on it.

Bored again, I felt I should have been picked up long ago. My legs were asleep. My clothing rubbed. Odd corners of packages and harness clips poked me, and I could imagine my bottom wrinkled like fingertips after washing dishes too long. Maybe, I began to fantasize, I'm lost. Or maybe they'll leave us out all night.

Then, suddenly, between my up-pointed feet, out on the horizon, a rocket gracefully arched into the sky—the signal for the pickup to begin. A bit later, a gnat appearing on the leering horizon slowly grew into my rescue boat. PS

Bob Gannon, author of this article and PS go-anywhere, do-anything reporter, has received a number of suggestions for adventure stories and is working on several for upcoming issues. If you have an idea for Gannon—something you'd like to do but can't, or something you would like to see him do—write him at POPULAR SCIENCE, *355 Lexington Ave., NYC 10017.*

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Your Guide to Buying a Chain Saw

[*Continued from page 154*]

wood to fireplace length as you need it.

All gas-powered saws are not *chain* saws. In addition to a number of industrial circular saws for heavy-duty construction, the Wright gas-powered reciprocating saw, now made by Beaird-Poulan, comes under this heading. This saw, sold in 16- and 20-inch models, has a number of merits that are really worth noting. The blade is an easily changed reciprocating saw that works much like an electric carving knife. On a typical wood-cutting expedition, it's no problem at all to take along several sharp blades and change as needed. Home resharpening is, perhaps, a bit less tricky than chain sharpening. A great feature for the average user is complete freedom from any form of blade lubrication. The Wright is also capable of making fine and accurate cuts for construction work. Prices range from $150 to $190.

Nearly all saw makers provide little booklets on general sawing practices and saw maintenance. Gleanings from these books are worth keeping in mind:

- Use your saw properly. Not all saws and chains are adjusted or tensioned the same way. Find out about yours.
- Lubrication. Air-cooled chain-saw engines are not water-cooled outboards. Use the oil recommended or sold by the saw dealer. The right oil and right mix are important.
- Chain oil. Use only good fresh oil for the chain. Some makers package both engine and chain oils; others say use clean engine oil. Never use old crankcase oil.
- Safety. Before starting to cut, clear away an area for good footing. A slip with a snarling saw in your hand is dangerous. Plan your escape route should the tree not fall quite where you expected.
- Look aloft. Watch for "widow makers"—dead limbs overhead that loosen from saw vibration and drop on the unsuspecting saw man. Borrow a hard hat if cutting high timber.

Carefully used and reasonably maintained, a chain saw will more than pay for its cost in a better-looking yard, ample firewood, and yeoman duty in emergencies. A hard look at the marketplace will turn up the right one for you. PS

Briggs & Stratton — Clinton New Gas Engine Sale

Never before and perhaps never again—this offer of brand new genuine Clinton and Briggs & Stratton engines including 1 yr. factory warranty *at less than cost*. Perfect power for go-carts, scooters, tractors, mowers, generators, pumps, sprayers, etc. We bailed out 3 big factories who needed cash and the savings are yours while quantities last. *Act fast. Order from Master Mechanic Mfg. Co.*

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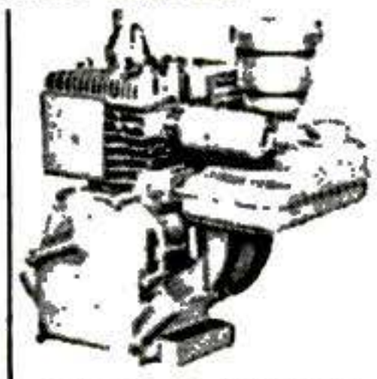
2 for $64.50
6 for $190.00



Briggs & Stratton 2½ hp, Mdl. 81106 Rope start, std. ⅝ shaft w. keyway. Sturdy 4 cycle power. Reg. price $49.80 Spec. (item 1518) **$34.50**

2 for $67.50
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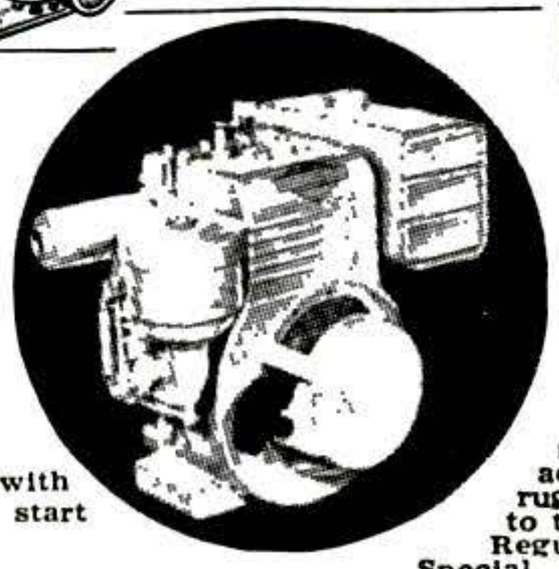
$69.95 5¾ hp. Briggs & Stratton



Same engine with 12 v. elec. start and battery charging (item 1571) **$89.95**

Briggs & Stratton 5¾ hp. Mdl. 143302. Recoil start. Std. 1" shaft w. keyway, and adjustable governor—a rugged big engine ready to tackle any job. Regular price ...$92.60 Special (item 1059) .. **$69.95**

2 for $135.00 6 for $375.00

2¾ h.p. Clinton—34.95

Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start ⅝" std. shaft Item 1107 ..... **34.95**
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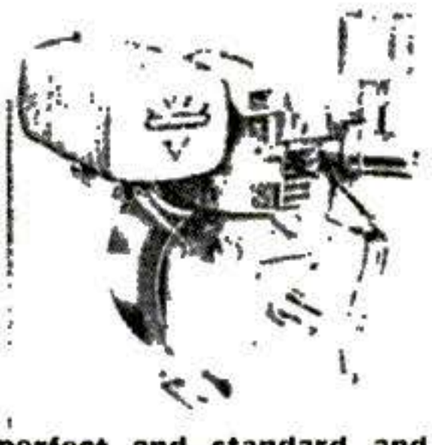

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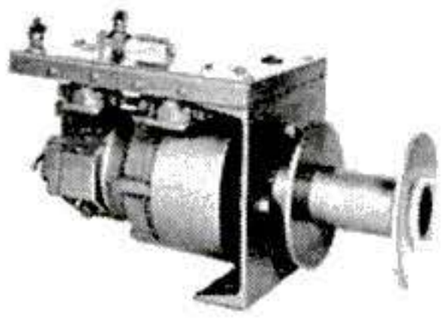

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How You'll "Drive" the Amazing Urbmobile

[Continued from page 78]

practically deserted except for local traffic."

Likewise, if the guideways were put in the median strip of a freeway, you'd need no service strip. Or one guideway could run along each outer edge of a freeway.

You glide off the guideway at your exit, and take over the controls to drive home. Tomorrow is Saturday, and you've promised the kids you'll take them for a ride on the Urbmobile system. It's easy enough. Once on the system, you keep dialing new destinations. Instead of being shunted off downtown, the car will be progressively switched to tour the system. A central computer will even keep track of how far you travel on the system and add the right amount to your bill.

Urbmobile cars themselves will need little guidance or control equipment—almost everything required will be built into the track system. Here's how it might work:

You'll tell the guideway control system where you want to go by displaying a sign in a window on the side of your car. Inside the window is a strip of fabric that can be rolled up and down, like the sign on a bus, by cranking the dial on the dash. On the cloth, instead of words for stations, are coded black-and-white marks. At every switching point, a trackside optical scanner looks at the coded message, reads your destination, and either switches you off or sends you ahead. This might be done by actuating one of a pair of arms, on the car itself, to engage guide rails. (An accompanying diagram shows one possible design.)

Whose cars? Many questions about Urbmobile remain unanswered. Perhaps the biggest: Who will own the cars?

They could be owned individually, as people now own their own cars.

But the whole plan might be a good bit simpler if the system owned all vehicles. When you finished work in the afternoon, you'd go down to the station and take the first car in line. You'd drive it off the guideway, take it home overnight, and return it next morning after driving it downtown.

This way, there'd be no problem of storing cars in numbered slots during the day and retrieving them on demand. The control system would be far simpler and cheaper. And individual cars would be used more efficiently. The car you released in the morning might be used by someone wanting to go to the suburbs or to another part of the city, instead of sitting idle all day. With a smaller total number of cars handling the traffic load, costs would be cut.

Which system ultimately evolves will depend on many factors, including how badly people want to own the cars they drive, rather than rent them.

Where it will work. The Urbmobile won't solve traffic problems everywhere, its backers point out. Only in fairly spread-out cities will it really be practical, their calculations show.

It should work beautifully in Los Angeles, New Orleans, St. Louis, Cincinnati, Denver, Houston. As a model in designing the system, CAL engineers are using Buffalo, another ideal area.

It won't work in cities with really dense central cores—New York, Philadelphia, Boston, Chicago. So great is their traffic load that they need rapid-transit systems able to carry up to 40,000 people an hour per lane. And Urbmobile, while many times better than an auto expressway, doesn't approach the efficiency of a commuter train.

Nevertheless, Urbmobile seems to have a good chance of success. And while the present study aims to design a system operable by 1985, those involved agree it could happen earlier.

"If our study survives HUD's scrutiny and the government decides to go into a development program," says CAL's Wolf, "there would have to be at least a year of intensive engineering studies to pick the best configuration. Then, in about two or three years, you could probably produce what I call a 'back-yard' system, a prototype that would not be exposed to the public. If that worked all right, I'd guess it would require another two or three years to build a full-scale demonstration project in some city. So, under the best conditions, it would take five to seven years to get an actual system going." PS

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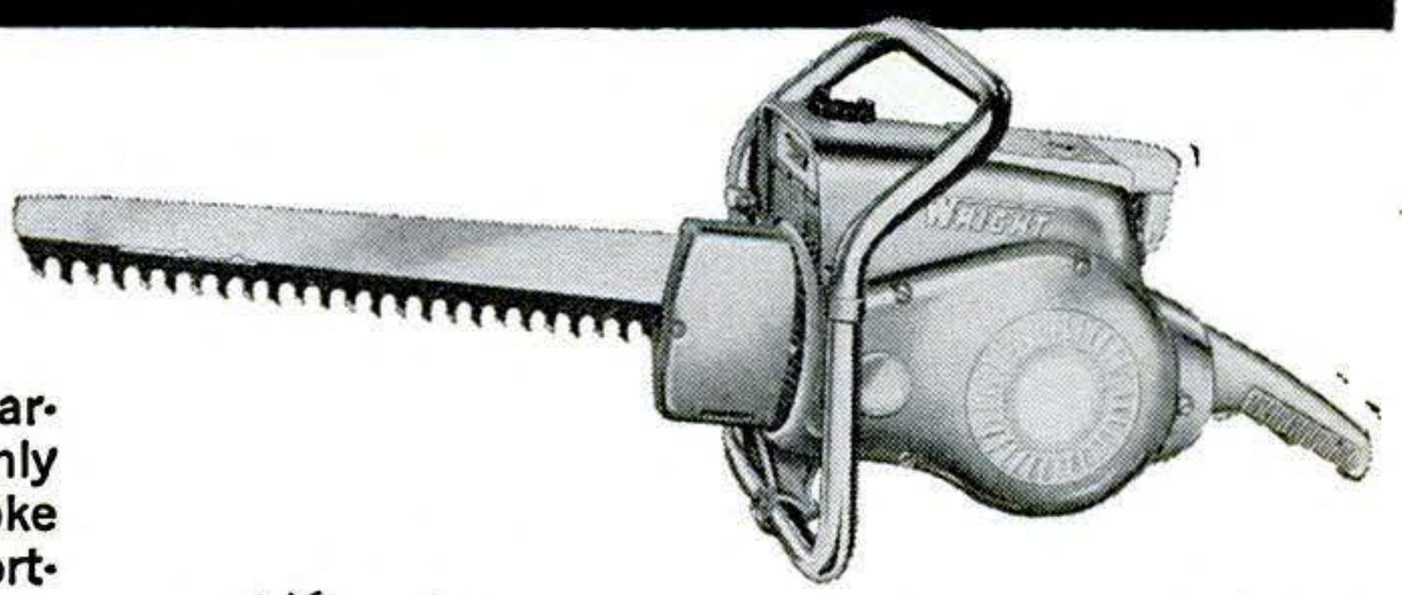

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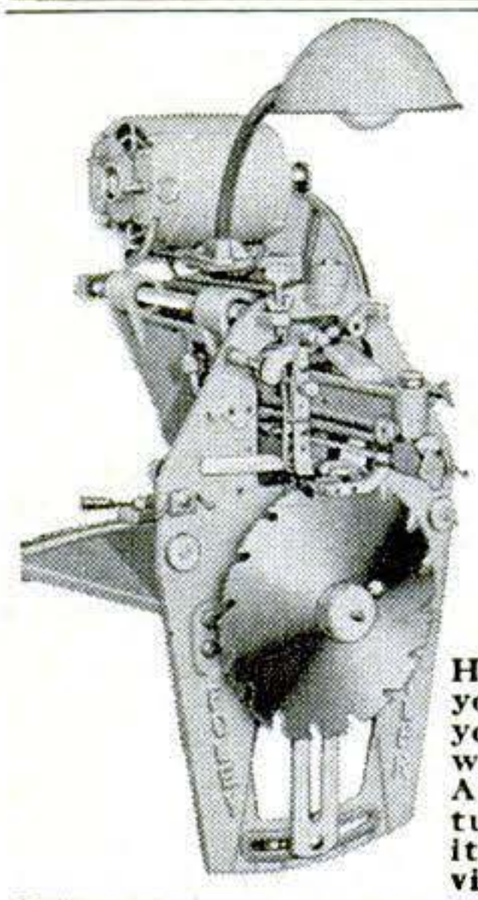

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Physics for Fun: Bernoulli's Paradox

[Continued from page 89]

the two surfaces provides sufficient lift to hold up the heavy plane.

A table-top experiment that you can set up in a jiffy will show you how air speeding over the top of an airplane wing holds it up. All you will need is a common drinking straw, a straight pin, and two eight-inch (or smaller) paper plates. (A photo shows how to use them.)

Atomizers and carburetors. Perfume atomizers, and paint and insecticide sprayers operated by compressed air, also utilize the Bernoulli principle. In each case, a tube dips into a liquid. Across the open upper end of the tube, air is driven at high speed by a rubber bulb or a pump. The pressure of this high-speed air is lower than the pressure of the still air around it. As a result, the higher pressure of the still air forces the liquid to the top of the tube, where it is caught in the air stream and spewed out with it.

The carburetor in your car is just a special form of atomizer. Here the lower end of a thin tube dips into a reservoir of gasoline. The upper end leads to the constricted section of a venturi (named for G. B. Venturi, an Italian pioneer in hydrodynamics who followed Bernoulli), a tube wide at both ends and tapering to a narrow throat in between. Air drawn through the venturi by the intake stroke of the car's piston is speeded up at the throat. There the air at low pressure draws up the gasoline, combines with it, and sends the combination into the cylinder as a fine mist.

Putting curve on a ball. A spinning baseball, a "sliced" golf ball, and a "chopped" tennis ball all curve because of the Bernoulli effect. As a ball spins, a thin film of air is carried around with it. On one side of the ball this spinning air is moving with the current produced by the forward motion of the ball; on the other side it is moving against the current. The result of such cooperation and opposition is that the air speed along one side of the ball is greater than the air speed along the other. As a result, the ball curves toward the side past which the air moves fastest.

By changing his grip on the ball, of course, a pitcher can control spin to produce a wide variety of curves. PS

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The '68 Outboards Are Here!

[Continued from page 130]

Biggest of the Johnsons—the high-performance GT-115—is said to be capable of producing single-engine speeds up to 65 m.p.h., twin-engine speeds of about 80. Specially contoured cylinder heads and piston deflectors, and a high-speed induction system with large carburetor throats enable it to gulp in all the air it needs to develop full power.

The Sears. All the high-power outboards for '68 are designed for use with a 100:1 oil ratio, utilizing a surface-gap spark plug. Alternator-generators keep batteries lively, charging even at idling speed. The big ones come with 28, 45, and 75 hp. Fishing motors are rated at four through 14 hp.

Outboard Jet. There's a jet-powered 16½-cubic-inch outboard for 1968, too. It's the OJ-200—a 9.5-hp. motor. Equipped with a jet drive, it has no propeller, and no projections below the hull. The motor is designed to take a boat anywhere it will float. It weights 57 pounds, is only 26 inches long.

The McCullochs. These continue to stress the compactness and portability in the lower-horsepower range of outboards fishermen and outdoorsmen go for. Of particular interest are the electric-starting 7½- and nine-hp. models. These are equipped with Bail-A-Matic to keep your feet dry in your boat even on a rainy day. It uses power from the motor to suck water out of the boat and put it back in the lake where it belongs. There are seven outboards for 1968, ranging from four hp. to 75.

The Homelite. America's only four-cycle outboard shows no changes for 1968. It still packs 55 horses into its 59.4-cubic-inch displacement. Since it is a four-cycle engine, you need not mix oil with the gasoline. Tested on a 16½-foot Boston Whaler weighing 700 pounds and carrying 500 more of payload, the Homelite burned 4.8 gallons of gasoline per hour, doing 29.5 m.p.h. At medium speed of 23.2 m.p.h., the motor burned 2.8 gallons of gasoline per hour. And at trolling speed of 1,000 r.p.m., it burned only 1.2 quarts per hour.

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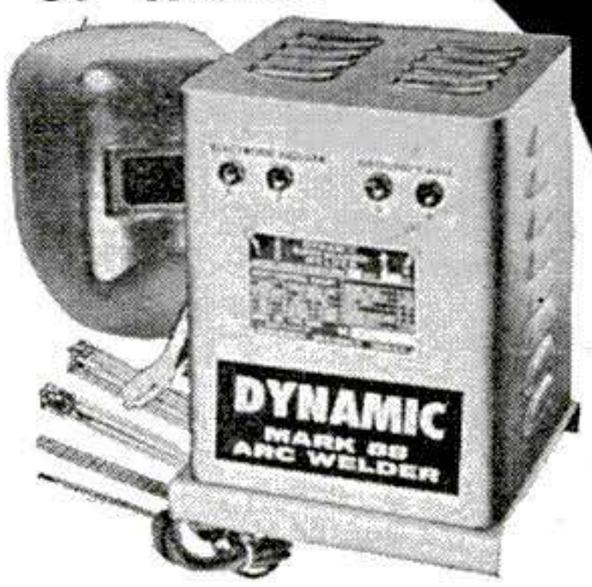

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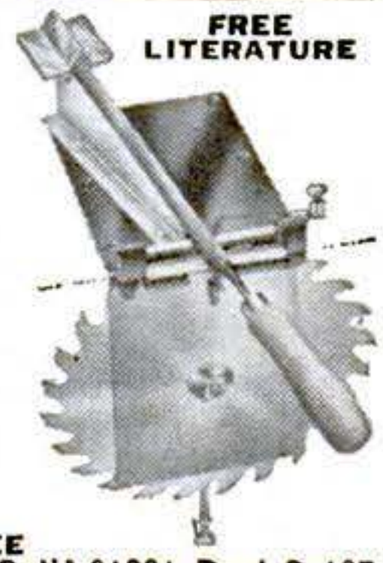

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World's Mightiest Fire Engine

[*Continued from page 97*]

The engine is coupled to a semiautomatic transmission with power takeoffs for driving the priming pump, or the air compressor that provides starting air for the main pump engine. Inside the forward compartment of the trailer is the heart of the system, a Napier-Deltic liquid-cooled engine rated 2,400 hp. at 1,800 r.p.m. The engine is an 18-cylinder, two-stroke, turbo-blown diesel weighing 13,000 pounds.

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The "business end." While the Super Pumper is the heart of the system, the Super Tender is the "business end." On its tractor is a monster high-capacity "Big Bertha" water cannon with a five-foot barrel. The cannon has a 450-foot reach shooting at a 70-degree angle, and the deluge from it penetrates deep into major fires and smashes down the walls of fire-weakened buildings.

The trailer of the Super Tender carries 2,000 feet of the special 4½-inch high-pressure plastic hose used with the pumper. The three satellite trucks also carry 2,000 feet apiece, for a total of more than 1½ miles of hose. The satellites mount smaller cannons, each fed by four inlets.

The Super Pumper never responds directly to a fire, but to the nearest adequate supply of water.

Many skeptics felt that the $875,000 cost of the new system should have gone for a large number of conventional fire trucks. But the world's mightiest fire engine has already paid for itself. PS

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120-Size Cameras Fight Back

[*Continued from page 135*]

tures of the blown-up 35 types seem in order: They will, like the cubes, all be SLRs. They will have built-in light metering, possibly even a meter behind the lens. They will be designed for eye-level viewing (the cubes are basically waist-level types, with pentaprisms as extras).

You can't talk about 120 cameras without mentioning the big workhorse 120 cameras such as Mamiya 23, Koni-Omega, Graflex XL, Linhof Press. These are heavy, do-everything, jumbos, made for precision work, where the first requirements are quality and versatility.

It is easy to fall in love with them. They are basically bodies on which you build the camera you want, choosing lens, back (for different negative sizes or for cut film), and accessories. Despite the weight, handgrips give you a secure hold, and quick film-transport mechanisms let you shoot action scenes with almost the facility of a 35.

Many photographers, of course, never switched from 120. The rugged and reliable twin-lens Rollei, along with its many imitators, is still a favorite with photographers. Rollei has made an effort to increase the versatility of its twin-lens by means of accessory lenses that convert the camera to wide-angle or telephoto use. But they are expensive and have not caught on. The Mamiyaflex, with true interchangeable lenses at a reasonable price, offers a simpler solution. Both of these fine cameras are, however, out of the mainstream of today's design developments—which means SLR.

Does a big camera necessarily involve big money? No. By and large, in terms of enlarging quality, whether for prints or projection, a good, reasonably priced (say $100) 120 camera will outperform almost any 35mm camera on the market.

Consider the arithmetic. Making an 8-by-10 print from a 35mm negative requires an enlargement of about eight times. The same size print from a 2¼-inch-square negative requires only a 4½-time enlargement. To match the print quality produced by that 2¼-inch negative, the 35mm film and lens must have twice the resolution—which in most cases they don't.

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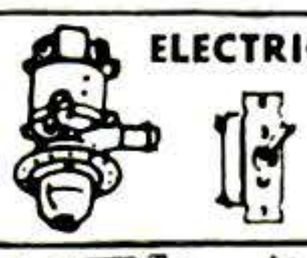

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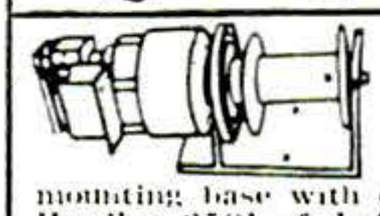

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Don't Let Tension Push You Around

[Continued from page 82]

"A muscle must relax," he says. "Relaxing is a part of its function. If it fails to relax, it stays tight. If it stays tight it loses its give, its suppleness. When this happens, the muscle loses most of its ability to release tension."

Sources of tension. Today, as a first step toward self-awareness, Dr. Kraus first orders his patients to take stock of themselves. Are they happy with their work and truly enjoying it? Do they get along with their associates? Then he asks them to search for humor in every knotty problem. "Laughter," he says, "breaks up tension."

"The all-important thing is that you should be satisfied and happy in your life. If you are not, make a change. If you cannot make a change, learn to accept your situation. You hurt only yourself when you put up with dangerous internal stress."

He prescribes:

- "Start the day leisurely. Eat a leisurely breakfast. Don't let the children upset you. A bad temper in the morning can set your mood for the day. And don't try to read the paper, listen to the radio, and keep an eye on the clock all at the same time."
- Dress properly. He believes in loose clothing, comfortable shoes, socks that do not constrict. He detests girdles for men or women.
- Adequate sleep is essential. "No matter what the ads say, the best mattresses you can sleep on are made of horsehair, hog's hair, or felt, and they come without springs."
- Wide shoulders can cause a stiff neck if you sleep on your side. "Be sure you have enough pillows. Avoid foam rubber. It tends to hold your neck in a rigid position."
- If you drive a lot, interrupt your trips at least every hour or so. Park and walk around, huff and puff, swing your arms, shrug your shoulders.
- Take breaks. If Dr. Kraus could make but one suggestion to a tense patient, he would ask him to break his work routine into small segments of 30 minutes to an hour. "Break it up," he says, "or it will break you up."

But his most potent weapon is teaching his patients to relax. You can learn, too.

Test yourself. Dr. Edmund Jacobson of Chicago made a brilliant breakthrough years ago when he observed that muscles that had learned to become tense could also learn to relax. His first step was to teach patients to identify the sensation of residual tension.

He asked them to lie down and close their eyes, with the arms resting beside the body. Then he told them to bend one hand up and back, bending it slowly and steadily, not seesawing, and bending it back as far as possible.

For a long minute, while they held the hand there, in that position, he told them to "observe carefully a certain faint sensation in the upper portion of the forearm. This sensation is the signal mark of tension wherever it appears in the body. Vague as it is, you can learn to recognize it."

Sometimes just discovering it took a patient two or three days.

Jacobson says, "When you understand what you are looking for, start afresh and bend the hand slowly back again. But this time, when it reaches its peak, relax your muscles and let it fall. Let it go completely. Let it fall limply."

Eventually, after releasing it, there is no tension left to feel.

Today, Dr. Kraus recommends Jacobson's principles and adds certain releasing exercises of his own. Once a muscle is relaxed, he has found over and over, it may be too weak to do its normal job. In this case, a stressful situation may tie it into knots again. His major contribution to the therapy of relaxing is probably his insistence on strengthening exercises. First, you release taut muscle. Second, you strengthen.

Dr. Jacobson was the first to see that tensed muscles could be trained to relax, and that age was irrelevant. Anybody could do it. Dr. Kraus was the first to advocate retraining the muscle to make certain it could do its job. Muscles are much like mischievous children, he feels. They are more inclined to stick to bad habits than to persist in good ones. Like children, they need a boss.

"How they behave and how your nerves behave," he insists, "is up to you." PS

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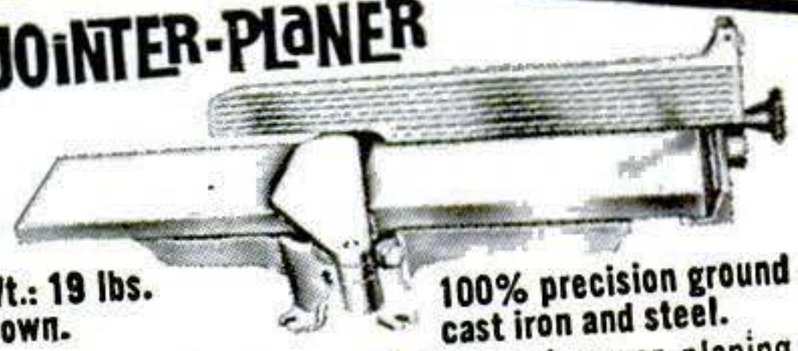

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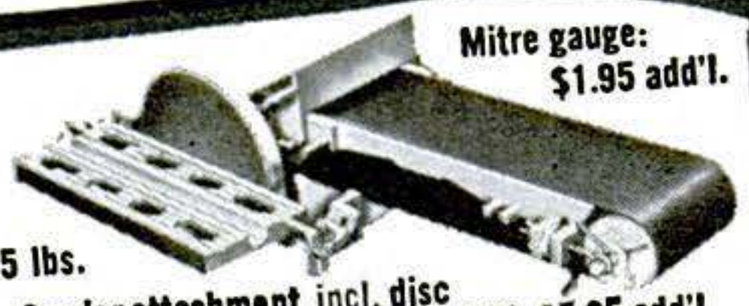

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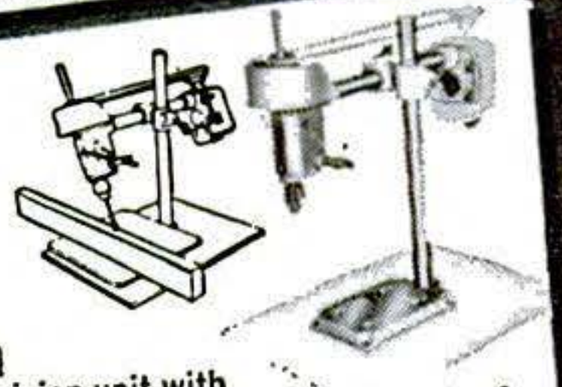

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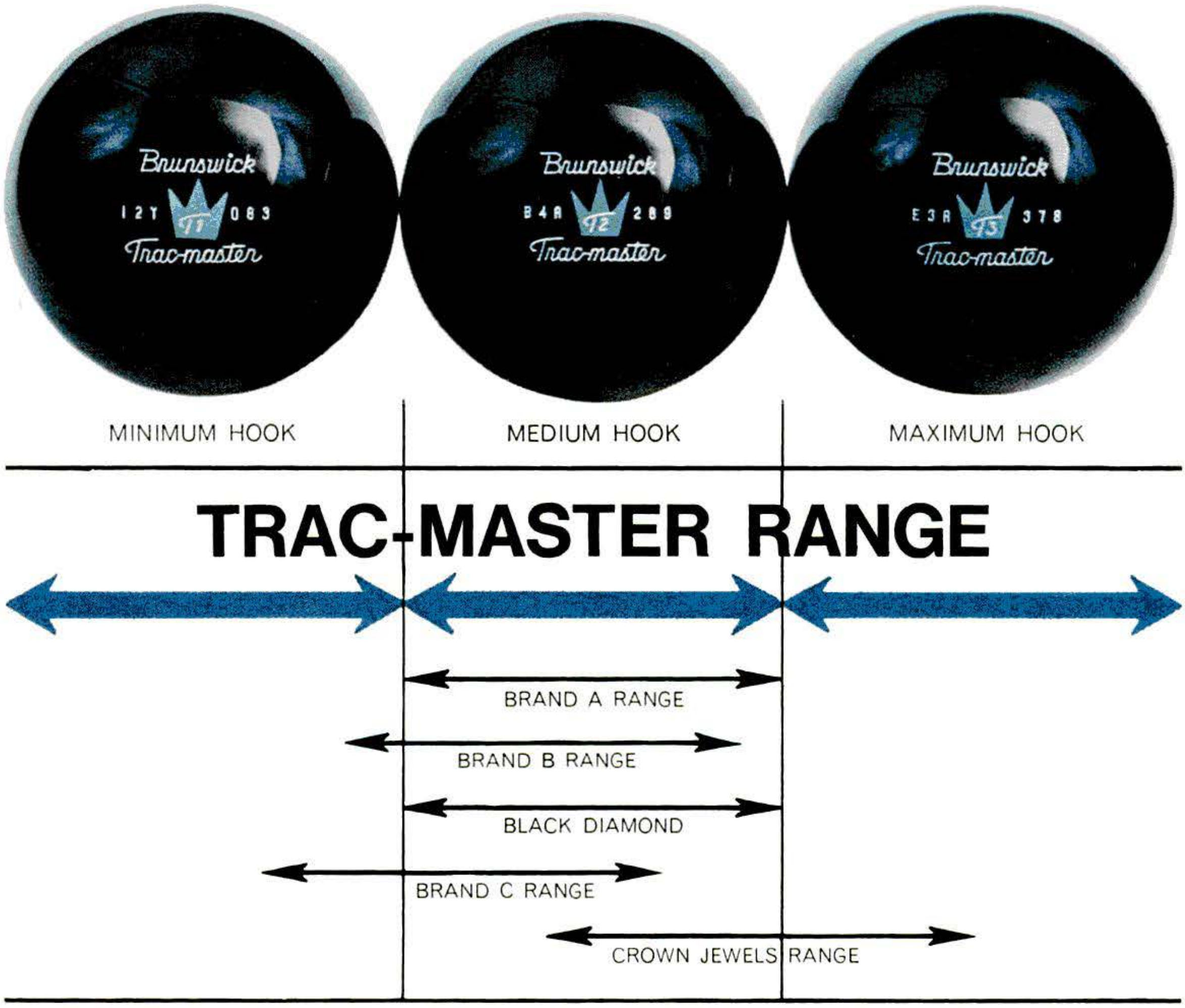

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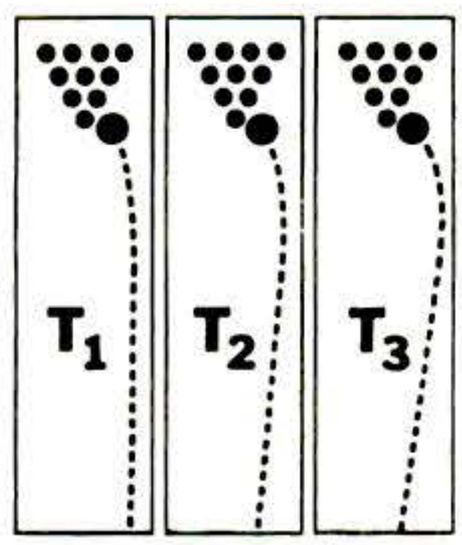

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